AN EXAMINATION OF PASSIVE LOCATION AWARENESS FOR SUPPORTING LOCAL COMMUNITY

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

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December 2017

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PASSIVE LOCATION AWARENESS FOR
SUPPORTING LOCAL COMMUNITY

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Cornell University 2017

Through my doctoral research, I aim to gain a deeper understanding of how LBPHDs, location-based, post-hoc data applications, can be leveraged to support urban communities. From a case study of a dating app that utilizes shared location history, happn, we showed that LBPHD information was meaningful in building interpersonal relationships. Based on these findings, we designed MoveMeant, an application that extends LBPHD from interpersonal to community-level information sharing. A pilot study suggested the potential of MoveMeant to increase local community awareness through dissemination of local knowledge and discovery of third places. We extended the findings from the pilot study to a large-scale field deployment of MoveMeant across three different communities. Using a research through design approach, we interviewed leaders of the communities in which we deployed MoveMeant to gain an understanding of the social structures in which we introduced the technology. Our findings suggest the potential warranting power of LBPHD to strengthen local ties, but also the risk of users interpreting the data to indicate differences within a community, an effect we call surfacing. Our findings offer design implications for community apps. Future work could determine if design might be able to overcome the effects of surfacing.

BIOGRAPHICAL SKETCH

Emily Sun is a PhD Candidate in Information Science and a member of the Social Technologies Lab at Cornell Tech. She has worked as a UX Researcher and Designer for companies like Airbnb, Sifteo, Google, Coca-Cola, and Disney Research. She holds a Master of Entertainment Technology from Carnegie Mellon University, and a Bachelor of Science in Engineering and a Bachelor of Arts in Psychology from Swarthmore College.

ACKNOWLEDGEMENTS

This dissertation would not have been possible without the help of many people. First, I would like to thank my advisor, Mor Naaman, for taking a chance on me and helping me grow into a better researcher. I would like to thank Geri Gay for her continued guidance on this journey, and Steve Jackson for his infinite wisdom and patience. The Information Science department has been nothing but supportive during this process, and I'm grateful to the many faculty, staff, and students who have helped me over the years.

Thank you to my family and friends without whose camaraderie I would not have been able to finish this dissertation. I appreciate your willingness to put up with my conversations on location tracking and words of encouragement. Ross, Xiao, Nir, and Matt, I couldn't have asked for a better group of labmates to collaborate and commiserate with. Thank you to Adrian, Carolina, Michelle and the all the participants who were willing to give their time for this work. Lastly, I would like to thank my parents for their love and support throughout this entire process.

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CHAPTER 1

INTRODUCTION

In 2014, there were 6.8 billion cell phone subscriptions, almost as many people as there are on the earth (Fernholz, 2014). The number of smartphone owners is continuing to rise, with 95% of Americans owning cell phones in 2017 (Center, 2017). The ubiquity of mobile phones and wireless internet has enabled people to keep in constant contact (Hampton, 2016a). At the same time, the growth of social networks sites like Facebook, Snapchat, and LinkedIn have facilitated communication within people's past networks that might previously have been difficult to maintain (Manago et al., 2012). Social media has allowed for a shift from *person-to-person* contact to *person-to-network* contact, lowering the overhead required to maintain awareness of others. As a result of technology, people's virtual networks have been strengthened (Naaman et al., 2010). Yet, the same pattern of growth has not been observed in people's local networks. In fact, the opposite trend has emerged.

According to the General Social Survey, the number of Americans reporting spending a social night with their neighbor at least once a month dropped from 61%, in 1974, to 46% in 2014 (Smith et al., 2015). Robert Putnam notes the decline in social capital that is both a cause and effect of decreased interactions within local communities (Putnam, 1995). As a result of this negative feedback loop, general levels of trust have continued to decline over time (Smith et al., 2015). As political researcher Marc J. Dunkelman describes, "With much greater frequency, neighbors have become, for want of a better phrase, similarly situated strangers" (Dunkelman, 2017). It seems that while virtual networks have flourished alongside the rise of mobile technologies, local networks have not.

However, local networks have significant benefits that virtual networks alone cannot achieve. Collocated people are key to building safety in urban areas by providing eyes on the streets (Jacobs, 1961) and buffering feelings of fear in dangerous neighborhoods (Ross and Jang, 2000). Further, collective efficacy, a group's capability to organize and take action for the benefit of the group, has been linked to reduced neighborhood violence (Sampson et al., 1997). However, collective efficacy is only possible when people have social capital resources and trust in their fellow residents (Grannis, 2009). The importance of local relationships is evident when examining the case study of Hurricane Sandy in New York City. Researchers found that social capital in a community was highly associated with the resilience of a neighborhood, regardless of socioeconomic group (Tompson et al., 2013). The importance of local community suggests that more work can be done to support the development of these networks.

The goal of the current work is to examine the potential of technology to strengthen local networks and abet community development. This dissertation includes material from several published (and one under review) articles, conducted in collaboration with multiple co-authors. This material appears in this dissertation with the permission of my co-authors. We look at the role of location information as an emerging and promising technology. As mobile phones are becoming more ubiquitous, companies have begun to leverage the mass amounts of data being collected on these portable devices. Location information has been utilized by companies like Google and Apple to improve their products and add new features, though not without concerns over user-privacy (Barth, 2009). In addition to providing data for companies, location information also carries a significant amount of social information that could be useful for design.

Places are not only defined not only by their architectural design, but by the way that they are used by people (Lefebvre et al., 1996). One example of the social meaning contained by places is that the ambiance of a place can be determined by the profile pictures of people who frequent that establishment (Redi et al., 2015). Apps like Foursquare and Facebook allow people to check-into locations that are broadcast to their social networks. Beyond the places themselves, sharing information about locations can enhance social exchange through parochialization, 'the process of creating, sharing, and exchanging information, social and locational, to contribute to a sense of commonality among a group of people in public space'' (Humphreys, 2007).

However, these apps rely on sharing location information with existing networks, limiting the ability of location information to be utilized for creating social connections. Other applications that focus on connecting unfamiliar others are location-based, real-time dating (LBRTD) systems like Tinder and Grindr that match individuals who are *currently* in the same location. Instead of limiting the value of location information to one's present location, a person's location history could potentially contain a greater wealth of social information. Compared to LBRTD, location-based, post-hoc data (LBPHD) could lead to a greater number of matches or even be used beyond interpersonal relationships. Work on community informatics suggest that location information could be an important factor in designing technologies for community development (Carroll et al., 2015a; Carroll et al., 2015b). In this work, we aim to understand if and how LBPHD could be used for strengthening local community.

For our work with LBPHDs, we needed to understand the challenges of designing technology for social interaction and what people had attempted before

us. Literature from sociology and psychology provide insight into the historical developments that led to the social separation in cities described above. Industrialization further separated the existing distinction between public and private life as community spaces have continued to decline. The challenge of establishing local connections is difficult, but HCI research shows that technologies such as mobile phones have blurred the distinction between public and private life in urban areas. Chapter 2 provides support for the importance of local networks and begins to suggest how technology, particularly shared location information, might be able to be used to benefit communities.

The dating app, happn, provides a unique opportunity to explore how common location information has been used to build interpersonal relationships. Happn reveals a small map of a place where potential dating matches crossed paths. Chapter 3 presents a case study of happn as it utilizes location information for social purposes. Interviews with happn users indicate the value of the social information that is extracted from location-based post-hoc data that reduces uncertainty about unknown others. The findings suggest the potential for using the data for relationship-building outside of a dating context.

The interviews with happn users provided inspiration for the development of our own app, MoveMeant. Chapter 4 describes the design of the app that extends location overlaps from interpersonal to community-level information sharing. The app uses anonymized location histories and aggregates the data to generate a list of frequented places by a community. We followed an iterative process to arrive at the design of the app. Our findings from a pilot deployment in a neighborhood in the Bronx borough of New York City indicated that the app was used to discover local places and make judgments about the people in

their neighborhood. Importantly, this information was shared without compromising privacy.

Expanding on the initial findings on MoveMeant and approaching the app from a community-level perspective, Chapter 5 explains the general challenges that communities face that may relate to MoveMeant. Following a research through design approach, community leaders across three field sites were interviewed: at Cornell Tech, an urban university campus, in East Harlem, a neighborhood in northern Manhattan, and in Jackson Heights, a neighborhood in Queens. The findings suggest that MoveMeant engages with awareness and has the potential to address issues of cohesion and identity, but on its own may not be able to aid with lack of political representation.

Chapter 6 presents a large-scale evaluation of how MoveMeant was used and interpreted by individuals in the same three communities where we interviewed organizers, as detailed in Chapter 5. The findings from interviews with users of the app suggest the potential for LBPHD to align with community leaders' awareness goals. However, we also find that lack of cohesion might be exacerbated by awareness of the same data. Our work suggests that location data could potentially be used for aiding community leaders in their work with political representatives.

Chapter 7 reflects upon the social theories discussed in Chapter 2 in light of the findings from the studies on LBPHD. In the final chapter, we propose future work that might explore the prevalence of and underlying social mechanisms behind surfacing. We bring everything together to establish a hopeful but cautious view of using LBPHD for community building.

1.1 Summary of Contribution

This work makes three types of contributions to the fields of HCI and CSCW. The first builds on research originally developed in social psychology on interpersonal attraction and later extended to social computing that uses technology to introduce unfamiliar people. The findings presented here provide an in-depth examination of how a new attribute afforded by mobile technology, location-based post-hoc data, is interpreted as social information. This understanding contributes to the growing literature on technology that connects individuals according to different traits.

The second contribution is in the area of design. This work provides field-data on how location overlap information could be leveraged as a feature of community apps. Since location information is already being collected by a number of companies, this research suggests ways that the existing data could be utilized for a different purpose. The current research also has implications for how communities are defined in community apps and suggests that beyond LBPHD, anonymized, aggregated data might be useful to provide social information in a privacy-preserving way in other contexts.

Finally, this work contributes a real-world example of research through design and a system created within the product service ecology. By deploying the app in the wild and understanding the social structures in which we introduced the technology, we were able to identify potential negative repercussions of using LBPHD for communities. This research provides a theoretical consideration of surfacing, a potential perceptual interpretation of differences within a group that may arise from awareness of data.

CHAPTER 2

BACKGROUND

As described in the previous chapter, the goal of this dissertation work is to strengthen bonds between people in the same geographic community. The current work aims to understand how increased awareness of a community's practices might help foster local ties. The following background section provides the motivation for this work and justification for our approach of leveraging location information for community building.

Social ties provide individual and community benefits, but urban areas are increasingly becoming fragmented. In Section 2.1, I focus on three different sources of this social separation in cities: the public and private divide, overexposure to others, and deterioration of public space. Political philosophers like Hannah Arendt and Jürgen Habermas engage with the historical developments that have led to the separation in public and private life (Arendt, 1958; Habermas, 1991), while sociology scholars like Richard Sennett and Georg Simmel discuss how industrialization has caused people to reveal less and less of themselves in public in modern urban life, resulting in the formation of urban identities that allow people to exist in the city entirely detached from social interaction (Sennett, 1992; Simmel, 1950). While community spaces used to serve as havens for people to socialize in the city, Ray Oldenburg's observations reveal the deterioration of these important spaces (Oldenburg, 1989).

One might argue that the trend of social isolation could be alleviated since widely available technology has allowed us to strengthen our virtual networks, eliminating the need for collocated networks. In Section 2.2, I contend that there remain benefits to having local, urban connections that differ from support from

distributed networks. Drawing primarily from Sociology and Psychology, research shows that local ties allow for sharing of resources (Putnam, 1995), promoting feelings of safety (Jacobs, 1961; Ross and Jang, 2000), and positive everyday experiences (Epley and Schroeder, 2014). These benefits extend from individual interactions to enable more resilient communities (Tompson et al., 2013).

One potential way of increasing social capital might be to utilize technology to blend public and private life. If the division between public and private has lead to fragmentation in urban life, then perhaps a considered and intentional blending between the two could alleviate its damage. In Section 2.3, I examine ways in which the now widely prevalent technology of mobile phones and wireless internet have upended traditional boundaries between private information and public space. These technologies allow people to engage in formerly private interactions, such as intimate phone conversations, in public areas surrounded by strangers (Sheller, 2004; Lee, 1999). Placemakers utilize this blend of public and private to engage with others in cafés (Hampton and Gupta, 2008). I highlight several examples from HCI of urban designs that encouraged private interactions in public spaces like devices that enable brief connections between strangers through jokes or tactile vibrations (Balestrini et al., 2016; Hansson and Skog, 2001) and shared private location information in the public forum of a cell phone app and wearable device (Paulos and Goodman, 2004; Humphreys, 2007).

Finally, in Section 2.4, I build off of the work described in Section 2.3 to propose one potential way of addressing social isolation using location information as a way of making private information public through selective ex-

posure. Locations carry rich social meaning that is important for community building (Mehl et al., 2006; Redi et al., 2015; Carroll and Rosson, 2013; Garbett et al., 2016), as spatial information is what people in cities have come to depend on in order to make judgments of strangers (Lofland, 1985). The information provided by locations has been used by HCI researchers for gaming and dating (Benford et al., 2006; Colley et al., 2017). Location has the potential to connect people through the social mechanisms of homophily (McPherson et al., 2001), exposure (Zajonc, 1968; Dillahunt and Mankoff, 2014) and cultural capital (Anheier et al., 1995; Hsiao and Dillahunt, 2017). More recently, companies have begun to track locations as well, but with a corporate rather than social benefit. Instead, we see the opportunity to use location capture for community building, blending public and private in privacy-preserving way.

2.1 Urban Isolation

> "Silently, without warning- that tide reversed and we were overtaken by a treacherous rip current. Without at first noticing, we have been pulled apart from one another and from our communities."
>
> - Robert D. Putnam, *Bowling Alone*

What is the cause of the 'rip current' that Putnam describes is pulling people apart from their communities? This section argues that one of the contributors to community fragmentation is the divide between public and private life that has resulted in a decline in social interaction in cities. Over-exposure to strangers may have exacerbated this problem, resulting in the development of urban identities separate from the rest of society. Furthering the divide is the decline of urban community spaces, which contributes to the modern-day stereo-

type of the isolated city-dweller.

2.1.1 Public and Private Divide

Exploring the development of public space requires a consideration of its counterpart: private life. The relationship between public and private space and life has changed throughout time. Hannah Arendt and Jürgen Habermas trace public life back to its root in Ancient Greece, while Richard Sennett and Gerog Simmel analyze changes in more modern times.

Hannah Arendt details the development of human existence, including a critique of traditional political philosophers like Plato and Marx. She emphasizes the importance of a vita activa, an active life, and designates three fundamental activities: labor, work, and action. Labor is the biological process that continues through life. Contrastingly, work is artificial and is activity that is created by the needs of humans. Action is the freedom to engage in the world, and is not forced upon people by nature, like labor, or utility, like work. Arendt celebrates the potential of action in her discussion of public discourse in ancient history.

Many modern Western ideals of public life refer to the Greek conception of the polis. The polis was the city-state structure of the Greek community that differentiated its laws from other poleis. The polis was open to all free citizens and operated in a different sphere from the oikos, the individual family unit. Inherent in this distinction between polis and oikos is the difference between public and private life. Arendt argues that the public polis would not have been able to exist without the private oikos when she says, “mastering the necessities of life in the household was the condition for freedom of the polis” (Arendt,

1958).

Jürgen Habermas is another figure who conceptualized the public sphere through a historical-sociological account. He defines the bourgeois public sphere as "the sphere of private people [who] come together as a public" (Habermas, 1991). He traces the development of the bourgeois public sphere, from its original roots in the polis. He explains, "their [Greek citizens] private autonomy as masters of households on which their participation in public life depended" (Habermas, 1991). While family and slave labor were under the control of the master of the house, the polis was "an open field for honorable distinction" (Habermas, 1991) where virtues of freedom and permanence were upheld. Both Arendt and Habermas speak to the essential dichotomy of public and private life that made public life possible.

The original rise of mass society introduced normalizing its members to follow certain rules and behaviors, thereby emphasizing equality amongst community members. In contrast, within the polis system was an inherent competition between individuals since excelling (aristoeiein) and receiving recognition was possible only in the public sphere. Arendt describes, "The public realm, in other words, was reserved for individuality; it was the only place where men could show who they really and inexchangeably were" (Arendt, 1958). Because in the private realm men were all the masters of their households, the public space provided an outlet for them to compete. Arendt further argues that this competition led to a focus on performance and evaluations based on public labor. As a result, people were less inclined to express themselves publicly and had to channel their emotions to the private realm. As Arendt describes, "our capacity for action and speech has lost much of its former quality since the rise

of the social realm banished these into the sphere of the intimate and the private" (Arendt, 1958). From the Middle Ages until the 18th century, publicness of representation existed rather than the separation between public and private as was seen in the polis. Habermas explains that the feudal lord and English king had "publicness," but these were status attributes and positions of power, whereas the people were passive spectators. Early finance and trade capitalism contributed to the genesis of the bourgeois public sphere, but rational-critical public debate was the cornerstone of this development. People in coffee shops and salons across Europe engaged in discussion built upon three institutional criteria: social equality, a domain of common concern, and inclusivity (Habermas, 1991). These conversations between propertied and educated people responded to art and literature, and then widened to include economic and political discussion. However, over time the bourgeois public sphere collapsed because of consumerism and the pursuit of leisure that replaced the political action and rational-critical debate that once existed.

The tension between public and private is the focus of *The Fall of Public Man* by Richard Sennett. Through an examination of the history of public space, he aims to answer the question, what has happened to public life? He notes, "to know oneself has become an end, instead of a means through which one knows the world" (Sennett, 1992) and that self-absorption has led to an elimination of feelings in the public realm. Like Arendt and Habermas, he traces the history of public space back to Roman times, but focuses his analysis on the 18th and 19th centuries.

Industrialism had a large indirect impact on public space interactions. The rise of the first department store in Paris, Bon Marché, meant that fixed prices

replaced haggling in streets for merchandise. As Sennett explains, "haggling and its attendant rituals are the most ordinary instances of everyday theater in a city, and of the public man as an actor" (Sennett, 1992), and by removing this element of interaction, people became passive in public. Georg Simmel argues similarly that in modern cities, the people who sell products are not the ones who produce the products, causing "the interests of each party [to] acquire a matter-of-factness, and its rationally calculated economic egoism need not fear any divergence from its set path because of the imponderability of personal relationships" (Simmel, 1903). This greater focus on practicality in commercial exchanges could lead to a further retreat of the private in public space.

Fashion is another area that both was influenced by the development of technology and contributed to public space. Whereas people used to go to into the streets or public gardens to see the latest fashions, by 1857, the newspaper eliminated this need to venture into public spaces by disseminating fashion immediately and privately (Sennett, 1992). Similarly, factory-made clothing meant that large numbers of people looked the same, revealing little about their identity and individuality (further examined in 2.4.1. Development of Location as Informational).

Taking these writings together, a complex relationship between public and private emerges. The public could not exist without the private, as discussed in the context of the polis, but the private also threatens the public. People reveal less and less of themselves in the public sphere by nature of the social relations in public but also exacerbated by industrialism and technological developments of the 19th century. How people interact in cities is further complicated by the overwhelming diversity and density of strangers which further divides public

and private as urban populations grow in size.

2.1.2 Exposure

The dualism of public and private life could be seen to contribute to the development of self-presentation in public. Self-presentation allows people to maintain their private selves while still being physically present in public. When one comes into contact with a large number of others, people have to put on a multitude of performances on a daily basis. This section engages with the influence of masses of people on the individual in a city. In public urban space, different types of identities develop in response to the constant social exposure: Richard Sennett's spectator and flâneur, Georg Simmel's stranger, and Erving Goffman's singles and withs. Diversity is a defining aspect of urban areas, but this exposure can be viewed as having a positive or negative influence on people. While exposure is detrimental to the individual from Simmels perspective, Sennett is more optimistic about exposure, and Jane Jacobs sees it as essential.

Diversity

Simmel begins his examination of urban life by identifying the antagonism between the individual and society. He argues that in cities, as compared to rural areas, people seek individuality in order to differentiate themselves from the rest of society, their fundamental motive being "the resistance of the individual to being leveled, swallowed up in the social-technological mechanism" (Simmel, 1903). He says that people living in metropolises have developed a defense mechanism against "the profound disruption with which the fluctuations and

discontinuities of the external milieu threaten it" (Simmel, 1903). People create a buffer to protect themselves from the constant stimulation of city life, which leads to an increase in logical reasoning. As a result of this emphasis on rationality, people who live in metropolises tend to be indifferent to others. They exhibit cold behavior due to the impracticality of interacting with all the people they encounter in a city, creating a hostile environment between strangers. This need to "show that our mode of existence is not imposed upon us from the outside" (Simmel, 1903), results in loneliness even when one is surrounded by people. In order to differentiate oneself from the rest of the city, people adopt eccentricities and only develop on a singular dimension to the detriment of peoples personality as a whole. To Simmel, exposure in a city causes detachment between people and stunted development of the individual.

In contrast to Simmel's negative view of exposure, Sennett revels in his exposure to the many different kinds of people he observes during his walk through New York. While masses of people increase separation between people, Sennet argues that "a city's thick impasto of experience should break down the boundaries of the self by sheer pressure of numbers" (Sennett, 1992). He describes his first-hand experience of making eye contact with an Indian merchant scolding his son, and his reluctance to voice his connection to the stranger as both being fathers because of the likely hostile response. To interact with others requires an act of admittance that "one must do the work of accepting oneself as incomplete" (Sennett, 1992).

Jane Jacobs attacked traditional notions of city planning through her examination of what makes cities safe or unsafe. She began with a simple observation: the North End of Boston, hailed as a dangerous slum, in fact seemed to

have been rejuvenated despite a lack of rebuilding. Based on this, she explored what ordinary behaviors could contribute to city life. She started with sidewalks, a staple of urban environments that link places and people to each other. In her discussion of how to make streets safe, Jacobs argues for three principle requirements: 1. Clear demarcation between what is public and what is private space; 2. Constant eyes on the street; 3. Continuous sidewalk use, which is achieved by having a diversity of buildings and people (Jacobs, 1961). With people on the sidewalks at all times, street crime is less likely to occur. A diversity of businesses, especially storekeepers and small businessmen, provide street watchers and more people running errands. Surveillance is most effective when people are intrinsically motivated to be using a space rather than through organized policing or designated watchers like doormen. These artificial eyes on the streets do not sustain safety if taken away.

Jacobs argues that designs meant to make cities safer like brighter street lights, parks and playgrounds are meaningless without people. Rather than design elements, she enumerates four necessary conditions to generate diversity: 1. Multiple functions for a district; 2. Short blocks; 3. Buildings that vary in age and condition; 4. Dense concentration of people. Mixed functions in an area ensure that different people will be using the same streets on different schedules. This contributes to street safety as described before. Shorter rather than longer blocks provide more potential paths for one to take to get to the same destination, which promotes people walking through more parts of a neighborhood rather than on isolated paths. Aged buildings next to new ones encourages a diversity of enterprises since older buildings can be continuously replaced with new ones that fit the needs of the people. This is an incremental process; As Jacobs describes, “Improvement must come by supplying the conditions for

generating diversity that are missing, not by wiping out old buildings in great swathes" (Jacobs, 1961). Lastly, Jacobs argues that high densities are actually beneficial and points to Greenwich Village as an example of an area with high densities and a variety of residencies.

Diversity is at the heart of what Jacobs argues is needed in cities: diversity of building uses, people types, time of activity, and building ages. She quotes Eugene Raskin, a professor of architecture, when he says, "It is the richness of human variation that gives vitality and color to the human setting" (Jacobs, 1961). From Jacobs viewpoint, exposure is not only a natural part of urban life; it is a necessary one for successful cities. Simmel, Sennett, and Jacobs show that diversity and exposure have a complex effect on the urbanite's psyche, and can even result in the development of particular social urban identities.

In his historical examination of the public man, Sennett identifies a shift from the 18th to 19th centuries. In addition to the man-as-actor of the 18th century, another identity developed: the spectator. The public remained an important space to the spectator, but not to engage with as a social being. Instead, these people felt like watching others allowed them to find a greater definition of themselves (Sennett, 1992). By focusing on their personal development, they were free from having to experience social relations. Sennett brings in Baudelaire's concept of the flâneur, a man "whose very life depends on his arousing the interest of others in the street" (Sennett, 1992). His entire existence depended upon being seen and explicitly not spoken to. This passive experience in public is embodied by the rise of massive banquets in Paris and London. These banquets of hundreds or even thousands of people would consist of uniform dinners followed by organized speeches. To contrast with the informal conver-

sations of cafés, the banquets were an "emblem of a society which clung to the public realm as an important realm of personal experience, but had emptied it of meaning in terms of social relations" (Sennett, 1992).

As opposed to the flâneur, Simmel identifies the social roles of the stranger, the poor, the miser and the spendthrift, the adventurer, and the nobility. Writing from Berlin in the late 1800s, Simmel had a pessimistic view of human life, considering it fragmented and inundated by conflicts. In understanding social behavior, he emphasizes the importance of form over content; form is the way that people interact with another to satisfy certain emotional needs and applies to many different kinds of relationships. He identifies the sociological tragedy of culture as the inevitable conflict between individuality and society. As society expands and encompasses a greater amount of diversity, people have less in common and are not able to interact meaningfully with one another. This perpetual tension and dualism is embodied by the stranger. The stranger interacts with society, but is similarly distant as he is "the potential wanderer" (Simmel, 1950). Occupying the position of trader, he is objective, but "it is a particular structure composed of distance and nearness, indifference and involvement" (Simmel, 1950). He is not an individual, but a particular type of person. The stranger experiences his close relationships from a birds-eye view, undifferentiating one person from another. He is "near and far at the same time" (Simmel, 1950), encompassing both the public and private spheres in one being.

Through *The Presentation of Self in Everyday Life* from 1956 and *Relations in Public: Microstudies of the Public Order* from 1971, Erving Goffman distinguishes between how people behave in front of others and by themselves and the unspoken language people use in public places. His classification is different from

the flâneur or the stranger as his roles are temporary states rather than identities. He distinguishes between "singles" and "withs," people who are alone or with someone else in public. Singles are often more susceptible to contact with others and may be judged for being by themselves. Therefore, "Singles, more than those who are accompanied, make an effort to externalize a legitimate purpose and character, that is, render proper facts about themselves easily readable through what can be gleaned by looking at them," (Goffman, 1971). They feel the need to justify their presence through involvement with other activities in the space. Goffman introduces the idea of portable involvement shields, objects like fans or masks that conceal facial expressions. When in the form of a book or newspaper, these objects can be used by singles to create a physical barrier between an individual and the other.

Recent research indicates that diversity and exposure have significant effects on social engagement. Using evidence from the Social Capital Community Benchmark Survey of 2000, Robert Putnam argues that in more diverse communities across the United States, people trust their neighbors less and resort to social isolation (Putnam, 2007). Putnam attributes this finding to *constrict theory*, whereby diversity reduces both bridging and bonding social capital. However, Keith Hampton claims that diversity alone might not be the cause of social isolation. Hampton compared results in a lost letter experiment measuring helping behavior in Canada and the United States in 2001 and 2011. His findings show that in the decade between the two experiments, helping behavior declined in the United States, but not in Canada. Instead of constrict theory, Hampton suggests that the differing attitudes and public policy towards noncitizens might be the cause of the difference in altruistic behavior between the two sites (Hampton, 2016b). These studies indicate that the effects of diversity are complicated

and relevant issues as globalism continues to increase.

Exposure in a city can cause people to react in different ways. Some like singles retreat into passivity, shying away from having to perform, whereas others like the flâneur use performance as a means to an end. Diversity can breakdown barriers and provide richness to city life, but also has the potential to isolate the individual who puts himself in a protective cocoon away from social overload. Taken together, this writing suggests that selective exposure might be ideal, enough to encourage diversity and meaningful engagement, but not too much as to overwhelm the individual. Certain spaces developed to allow for this kind of selective exposure, in the form of third places.

2.1.3 Deterioration of Public Space

Writing in the 1980s, Ray Oldenburg provides a modern sociological perspective on people interacting in public space. He observes German-American beer gardens, English pubs, French cafés, and American taverns to argue for the decline in what he calls third places.

Oldenburg defines the third place as "the core settings of informal public life...that host the regular, voluntary, informal, and happily anticipated gatherings of individuals beyond the realms of home and work" (Oldenburg, 1989). Third places stand in contrast to the first place, home, and second place, work. While first and second places were the same pre-industrialization, they became separated with the divide between private and public life as described above.

Oldenburg defines third places by a number of attributes, including that

they are neutral ground where conversation is the primary activity. They are often taken for granted and keep a low profile, not a place that would appeal to tourists but instead maintain a regular clientèle. Because the place attracts a known group of visitors, people are able to go there alone at any time with the assurance that they will know someone there, and people leave and arrival fluidly at different times. Much of the attraction in a third place is not provided by the management but by the fellow customers. He explains that the people in a third place satisfy the "paradox of sociability" since "one must have protection from those with whom one would enjoy sociable relations," and third places allow for this kind of buffer. Even though socialization itself may seem trivial, Oldenburg says, "When the good citizens of a community find places to spend pleasurable hours with one another for no specific or obvious purpose, there is purpose to such association" (Oldenburg, 1989).

Oldenburg emphasizes the importance of third places beyond pure escapism from the daily grind. Rather, the informal interactions afforded by third places provide possibilities that might not be associated with formal associations. "Without having to plan or schedule or prepare, those who move about in a familiar and casual environment have positive social experiences. They bump into friends; they receive daily doses of novelty, diversion, and social support." These benefits could extend to help alleviate more serious social issues. He said, "Even poverty loses much of its sting when communities can offer the settings and occasions where the disadvantaged can be accepted as equals" (Oldenburg, 1989). The benefit of third places is not solely for the individual; Oldenburg argues similarly to Jane Jacobs that populating third places deters crimes since having people at sidewalk cafés "represent some ten thousand outposts at which millions of ordinary people keep unconscious vigil even while enjoying

their city." He also argues that third places could encourage general reciprocity, whereby "As surely as people develop a fondness for one another and meet regularly, they will give one another things, loan tools, books, and other objects, give of their time and labor on occasion, and tell one another about useful sources of goods and services."

Third places are especially important when considering the formation of neighborhood communities. Social scientist Rick Grannis argues that neighborhood relationships develop in four stages (Grannis, 2009). In stage 1, individuals are geographically available to each other, followed by stage 2 when they casually encounter each other. Stage 3 is the intentional initiation of contact, and finally, stage 4 is mutual trust. Third places support the neighborhood relationship progression from stage 2 to stage 3; by providing a physical venue in which neighbors can gather and unintentionally learn about each other through observation, they are more likely to gather enough information to prompt them to actively make contact and form bonds.

Despite the benefits of third places, Oldenburg notes their decline. "What urban life increasingly fails to provide, and what is so much missed, is convenient and open-ended socializing- places where individuals can go without aim or arrangement and be greeted by people who know them and now how to enjoy a little time off." He argues that the weak ties that develop from such interactions is complementary to intimate relationships found outside of third places. He likens association with a third place to affiliation to a group or organization since people often meet in groups. However, Oldenburg argues that "where once there were places, we now find *nonplaces*." Similar to the effect of industrialization on individual expression, he argues that in nonplaces, "char-

acter is irrelevant and one is only the customer or shopper, client or patient, a body to be seated, an address to be billed, a car to be parked."

Mobile technology might also be contributing to the evolution of third places. Mobile social networks allow for the formation of temporary third places by easing the coordination of casual friends (Humphreys, 2007), but these fluid third places are dependent on existing networks and not on neighbors. Social networks may contribute to the decline of true third places since the technology affords persistent awareness (Hampton, 2016a). For example, if people who meet in third places were to friend each other on Facebook, they would be able to learn about each other's lives absent of the physical venue in which they met. While the increased knowledge of what other people are doing could help people advance more quickly through Grannis' stages of relationship, the accessibility of information could also contribute to the decline of the places themselves as the sole locations where people could obtain information about others.

While third places could be a way of bridging the public and private divide by allowing people to have selective exposure to others, these spaces are on the decline. The value in third places that is deteriorating is the ability to establish informal, social connections, which is the topic of the next section.

2.2 Importance of Local Networks

Local networks are important for providing emotional and physical support. Research shows providing networks for individuals can be highly beneficial. One might argue that the development of technology has allowed people to

move beyond the need for local relationships, instead relying on our virtual networks. Given the growth in virtual networks, why are local connections important to maintain? In the following section, I argue that local communities are able to provide different support than that from distributed networks. Collocation allows for sharing of resources, enabling physical support and building social capital.

Social relationships serves as a private and public good, leading to better living conditions within a community. Social network services alone may not be able to identify and provide the same emotional or physical support that people receive in the physical world. Face to face networks lead to better life expectancy (Christakis and Fowler, 2009). As described before, one contributing factor to the benefit provided by a local community is that collocated people are key to building safety in urban areas by providing eyes on the streets (Jacobs, 1961). A phone study of over 2000 residents in Illinois surveyed people's perceptions of their neighborhoods. Their results showed that social ties, not formal participation in a neighborhood organization, buffer feelings of fear in dangerous neighborhoods (Ross and Jang, 2000). The importance of social relationships is evident when examining the case study of Hurricane Sandy in New York City. Researchers found that social resources in a community was highly associated with the resilience of a neighborhood, regardless of socioeconomic group (Tompson et al., 2013). Like described by Oldenburg, social capital establishes a norm of generalized reciprocity such that individual members are more willing to help each other without expectation of return (Putnam, 1995). However, many obstacles remain that prevent this idealized view of sharing from coming to fruition, including mistrust (Sun et al., 2017).

Recent research has shown that even those in urban areas could desire more social interaction than they currently have. An experimental study by behavioral scientists Nicholas Epley and Juliana Schroeder provides evidence that socializing with strangers could be a pleasant experience. They instructed commuters on a train to connect with a stranger, remain disconnected, or commute as normal. Even though people do not think they want to talk to strangers on the subway, when instructed to do so, participants actually enjoyed their ride more than those who keep to themselves (Epley and Schroeder, 2014). Epley attributes this misalignment between perception and reality to *pluralistic ignorance*, the tendency for people to think everyone privately holds a certain attitude that is actually fallacious.

Even in urban environments, there may be benefits to establishing local ties. Despite our proclivity to remain only in our virtual networks and our reluctance with sharing private information in public, extending to our local networks can be beneficial both socially and functionally. One potential way of encouraging network development is explored in the next section.

2.3 Impact of Technology on Blending Public and Private

How can local networks be strengthened? I argue that blending public and private space could help combat the decline in third places and increase social capital. If the division between public and private has lead to fragmentation in urban life, then perhaps a considered and intentional blending between the two could alleviate its damage. First, I examine previous ways in which technological designs of mobile phones, wireless internet, and public displays have

merged public and private life.

2.3.1 Mobile Phones and Wireless Internet

Sennet showed that advances in technology complicated the dichotomy between public and private life. The automobile allows passengers to move through public while in a "cocoon of private space" (Lofland, 1985). As technology has continued to develop with the advent of personal computing, this tension has grown as well. In her study of mobile publics, sociologist Mimi Sheller posits that phones have a blurred the distinction between private and public spaces. Instead of having discrete areas that are designated as private or public, mobile phones allow for a "constant flicker of conversation" (Sheller, 2004), where people are accessible at all times. Instead of considering people as nodes in a network, Sheller prefers to adopt Harrison Whites notion of a gel instead (White, 1992). By thinking of connections between people as a gel that is constantly flowing and coupling and decoupling across time and space, mobile technologies allow people to adopt multiple social identities at a given time. Similar to mobile technology, internet use at cafés is another example of blending public and private space. Through interviews conducted at a café in England, Sarah Lee notes that the environment in a public internet café is an atomized and profoundly uncollective experience so that consumption of technology in this context remains an individuated and discrete act (Lee, 1999). Even though people are using technology in a public place, their interactions are private. While some users incorporated visits to the café as part of a social ritual, like a man who met his mother weekly to send e-mails to relatives in Italy, these interactions were still considered private. Lee also comments on the

frequent use of public internet cafes by travelers as way of connecting them to their private lives back home. Laura Forlano's ethnographic observations at a café in New York City further support the gel concept when she describes how café patrons would often go outside to make phone calls. Even though the café would be regarded as relatively more private than the city sidewalks, people would go into the streets for privacy during their calls. Lee Humphreys' observations of mobile use between dyads in public spaces reveals similar blending between public and private. If one person in a pair received a call, then the other person became a Single in Goffmans terms and occupied themselves sometimes by playing with their own phone. In addition to using a defense mechanism against social vulnerabilities of being a Single, a person distancing himself also created more of a private space for a partner to have a conversation on the phone. In a comparison of video of public spaces between 1979 and 2010, Hampton, Goulet, & Albanesius found that mobile phone use was associated with an increased likelihood of lingering in public spaces where people might otherwise be isolated, rather than when people were in groups (Hampton et al., 2015). The authors argue that mobile phone use allows people to connect remotely to others when alone rather than increase social isolation in public spaces.

In the same way that mobile phones could be used for socializing or distancing oneself in public, the technology of WiFi can be adopted for either purpose. Forlano's data showed that the reason 23% of WiFi users used WiFi was because they "wanted to see familiar people or be part of a community" (Forlano, 2008). In their observations of cafes that offer WiFi, Hampton & Gupta distinguish between two kinds of WiFi users: true mobiles and placemakers. True mobiles visit the cafés for productivity and use laptops as portable involvement shields

to signal their unavailability to others. Placemakers, on the other hand, are more open to meeting others and go to the coffee shop because of the "inherently casual sociability" of the place (Hampton and Gupta, 2008). As opposed to using their laptops as barriers, placemakers often use the shared screen to engage with others by watching a video together or reading something off the screen to someone else. Placemakers were almost always locals that visited nearly daily, while true mobiles would report one or two visits per week.

In her case study on Dodgeball, Humphreys argues that mobile social networking sites contribute to parochialization. Parochialization, as defined by Humphreys, is "the process of creating, sharing, and exchanging information, social and locational, to contribute to a sense of commonality among a group of people in public space" (Humphreys, 2007). Dodgeball, the predecessor to the application FourSquare, allowed users to 'check-in' to semi-public spaces like bars and restaurants and broadcast this information to their friends. Humphreys' interviews reveal how people change their courses of action based on information from Dodgeball; interviewees would often redirect their route towards a location where their friends had checked-in, or sometimes their path would be diverted from a place if they wanted to avoid seeing certain people. Instead of having one location that acted as a 'third place,' where regulars meet at one corner bar or cafe, the ease of coordinating with people allowed for multiple physical locations to become 'third places.'

2.3.2 Interactive Public Displays

Beyond the pervasive technologies of mobile phones and WiFi, a number of interactive public displays have been designed and deployed by HCI researchers to understand how they affect social interaction. Jokebox was a system installed in Mexico that required two people to press buttons at the same time to play a joke (Balestrini et al., 2016). The placement of the boxes were such that people had to coordinate their button-presses through eye contact and counting. Balestrini et al. found that the jokebox caused people to interact even if it did not trigger a joke; the jokebox remained a source of discussion. CityWall, a research project in Helsinki, placed a large touchscreen in an empty storefront on a busy public street. The screen gathered images tagged with the keyword 'Helsinki' from Flickr, which people could scroll through and scale and rotate by touching the images (Peltonen et al., 2008). Their observations showed that strangers mostly interacted with the screen in parallel, creating their own separate work areas so as not to disturb the other person. Several projects offered various paths for initiating social interactions in public places, from allowing people to chat on their phone with passengers on the same train in Trainroulette (Camacho et al., 2013), to sending a tweet to encourage strangers who checked into the same airport to meet up while waiting for their flights (Grevet and Gilbert, 2015).

Another concept created for indirect contact was the LoveBomb (Hansson and Skog, 2001). It was designed for users to express affect to strangers through tactical vibrations of a device. Even though the device was designed for anonymous sharing, focus groups thought that it could be used to establish connections with other people in nearby proximity. Jabberwocky was a prototype designed to allow people to gauge their familiarity with urban spaces (Paulos

and Goodman, 2004). Devices fixed to locations like bus stops and Bluetooth from people's mobile phones would be digitally tagged. A wearable Mote device would light more LEDs according to the number of people who had been tagged previously. Instead of focusing on communication, this device creates awareness that the people in the same space may be people who are seen with regularity. Local awareness was amplified in another project in the United Kingdom, which used a simple voting mechanism in town shops and visualized the data by spray painting them on sidewalks (Koeman et al., 2015). Local residents and visitors alike were able to gain a snapshot of public opinion on questions related to the community.

The strict dichotomy that allowed public spaces to form originally has eroded through the development and use of technology to the point that it has become a gel, allowing people to switch from public to private while still physically in public space. Goffmans theatrical framework is still relevant as people continue to perform everyday through their interactions with other people, but teams of performers are defining new situations and negotiating appropriate ways of acting. Because of this gel between public and private, people must switch roles more frequently; not only are people acting according to who is physically present, but they also must account for phone calls and their online presence at all times. From forced social interaction to increased local awareness to parochialization, previous designs have attempted to break down the urban barrier. Taken together, these projects and studies show how technology has blurred the distinct lines between public and private. I now turn to location as a potential source of blending private and public information.

2.4 Meaning of Locations

As Humphreys showed with Dodgeball, location information carries significant social information. Sociologist Lyn Lofland further argues that spatial information is what people in cities have come to depend on in order to make judgments of strangers. The rich information provided by locations has been used by HCI researchers for gaming and dating, and has the potential for building social capital through the development of cultural capital, homophily, and mere-exposure. Companies have begun to track locations as well, normalizing the idea of sharing location data, though not for community gain. Given the social information that can be extracted from locations, I argue for the ability to utilize this data to bridge the disconnect between private and public.

2.4.1 Development of Location as Informational

In *A World of Strangers: Order and Action in Urban Public Space*, sociologist Lyn Lofland conducts an examination of how people in cities have adapted to living amongst strangers. She notes how historically, strangers once were "evocative of wonder, curiosity, astonishment, hostility, hospitality, suspicion, and delight" (Lofland, 1985), yet in cities people live amongst strangers on a daily basis.

She distinguishes between appearential ordering and spatial ordering, which provide different mechanisms through which to identify information about strangers. Appearential ordering is based on a person's body presentation through clothing, hair, style, etc, while spatial ordering is based on the particu-

lar location information. Lofland argues that industrialization and the growth of the middle class caused a shift from appearential to spatial ordering. This shift happened for several reasons: the influx of rural populations into cities that were unaware or disdainful of appearential order, the mass production of clothing that made outfits formerly reserved for the elite widely available, and the increase in physical size of cities that allowed for greater spatial segregation of people possible (Lofland, 1985).

As a result, the twentieth century found cities reliant on location instead of appearance as a way to identify strangers. Permits and legal regulations relegated activity to distinct physical locations that was formerly in mixed-use public space. As Lofland summarizes, "In the preindustrial city, space was chaotic, appearances were ordered. In the modern city, appearances are chaotic, space is ordered. In the preindustrial city, a man was what he wore. In the modern city, a man is where he stands." She explains that much of people's understanding of how to code locations is dependent on being informed of them by family members, friends, and acquaintances as well as through media like television, newspapers, and guide books. Increasing knowledge of a place can eventually transform a public space into a semiprivate one, where one is aware of the ebbs and flows of the locale, similar to the concept of third places described by Oldenburg. Location information has also been shown to often reflect personality, and is in turn interpreted by others as a source of personality and social cues (Mehl et al., 2006). Participants were able to judge the aesthetics of a place based on the profiles of the people who frequent that locale (Redi et al., 2015). The importance of locational over appearential information signifies that location could potentially be a rich source of private information that could and has been used for a variety of different purposes in HCI.

Because of location information, strangers can become familiar strangers. Back in 1972, Stanley Milgram showed the existence of *familiar strangers*, people whom an individual recognizes but does not interact with (Milgram, 1977). These familiar strangers are based on similar geographic patterns. In 2013, data using smart card transactions on public transit validated that encounters follow a temporal pattern of repeated exposure to the same people (Sun et al., 2013). Previous research on location-based social networking applications has shown that simply displaying who's nearby does not necessarily turn strangers into acquaintances (Sutko and de Souza e Silva, 2011). The *networked familiar stranger* (Schwartz, 2013) that describes how location-based services such as Foursquare facilitate local interactions with strangers remains largely unrealized. Location data has become increasingly relied on for social information, yet even as mobile phones collect more data, locations have not been fully utilized to connect people who have similar geographic patterns.

2.4.2 Limitations of Location Utilization

When used in design, location information has often been limited to real-time data. Pervasive games and augmented reality games in particular, have seen growth due to the prevalence of mobile technology and location tracking. Can You See Me Now? was a game of catch between virtual players online and people physically running in the streets (Benford et al., 2006). Pokémon Go and its predecessor, Ingress, are applications that utilize the phones GPS to overlay a virtual game layer on top of a map. Research on Pokémon Go shows that its design results in human movement that reinforces existing geographic biases (Colley et al., 2017). Other applications are location-based, real-time dating

(LBRTD) systems like Tinder and Grindr that match individuals who are currently in the same location.

Applications like Foursquare that allow people to check-into locations are broadcast to existing networks, limiting the ability of location information to be utilized for creating social connections. Individuals use various types of location cues to communicate information to others (Humphreys, 2007), and receivers are adept at making sense of these location-based cues. Most of this research focused on systems where users explicitly share their location "check-ins" (Cramer et al., 2011; Humphreys, 2007; Patil et al., 2012), showing that people use Foursquare check-in for performative reasons (Cramer et al., 2011; Patil et al., 2012; Rost et al., 2013), and have "concerns for presenting themselves in certain ways" when sharing location over time with friends (Barkhuus et al., 2008). People are able to have limited interactions with other users of the app through seeing a person's profile repeatedly appear in multiple venues, but the information about the other person is often limited to that of a familiar stranger (Schwartz, 2013). The information shared on location-based apps is also part of one's *spatial self*, an online self-presentation based on displays of offline physical activities (Schwartz and Halegoua, 2014). Instead of limiting the value of location information to one's present location or existing network, a person's location history could potentially contain a greater wealth of social information that could be used beyond interpersonal relationships.

Location tracking is an increasingly common feature of popular applications and systems like Google Maps, Facebook, and Apple's iPhone. Personal location history is captured by these companies to benefit the user experience of their products by providing more accurate traffic information [1], easing coor-

[1]https://googleblog.blogspot.com/2009/08/bright-side-of-sitting-in-traffic.html

dination between friends [2], and present relevant advertising [3]. However, this power dynamic ensures that people are not the ones in control of how their data is used or can benefit them. This research aims to understand the social information that location history contains and how it might be able to be utilized instead for community benefit.

2.4.3 Location for Community

A smaller subset of HCI research has explored the relationship between geographic location and community development. In their work on local community development, John Carroll and Mary Beth Rosson identify the contribution of HCI research to make community knowledge visible, create diverse infrastructure, make community places more visible, and engender participation. They highlight the importance of place as "the most basic shared community infrastructure. Making place more visible to the community, making it a more active resource for community information and interaction is a strategy for strengthening this traditional source of community identity" (Carroll and Rosson, 2013). Researchers at Newcastle University developed App Movement, a platform that allowed communities to generate their own location-based review applications. Their long-term deployment highlighted case studies with three different types of communities and showed that locations are valuable for communities (Garbett et al., 2016). Another app , Journeys, used overlapping endpoints to allow users to check into journeys and leave notes to one another traveling on the same path. Their findings from a large-scale field study showed that the app was able to facilitate knowledge sharing and human contact asyn-

[2]https://newsroom.fb.com/news/2017/03/introducing-live-location-in-messenger/
[3]https://support.apple.com/en-us/HT202074

chronously and pseudonymously (Cranshaw et al., 2016). Despite the importance of locations for community building, utilizing location information has not been fully explored. The next section describes how community might be aided by having access to this information.

2.4.4 Building Social Capital through Location Sharing

How can location information abet community-building? Grannis argues for the importance of social capital, the resources accumulated through relationships (Coleman, 1988). He says, "social capital is not a characteristic of individuals; it is a supra individual property of social structure, and it seems to be particularly well grounded in neighborhood communities" (Grannis, 2009). Here, Grannis implies that increasing social capital could help strengthen communities. Previous research suggests that location has the possibility of being utilized for building social capital via different mechanisms: cultural capital, homophily, and mere exposure.

Bourdieu distinguished between economic capital, cultural capital, and social capital as different types of resources (Bourdieu, 1986). Cultural capital exists in various forms, including *incorporated* cultural capital, in the form of education and knowledge, and *symbolic* cultural capital, the ability to define artistic standards and styles. Locations have the potential to build both types of cultural capital, through spreading knowledge of cultural spaces that could allow individuals to educate themselves. Cultural capital is easier to convert into social capital than the other way around (Anheier et al., 1995), suggesting the potential for leveraging the cultural capital gained through location awareness

for social capital. Indeed, people-nearby applications have been shown to allow people to develop social and cultural capital (Hsiao and Dillahunt, 2017).

Surfacing similarity between people is another mechanism for increasing social capital. Homophily, colloquially referred to as "birds of a feather," suggests that individuals are likely to have affinity towards others who are like them (McPherson et al., 2001). Homophily helps reduce uncertainty about unknown others (Berger and Calabrese, 1975; Gudykunst, 1985). Previous research shows that showing similarities that strangers have can encourage social interactions between them, especially if the attribute is contextually rarer (Mayer et al., 2015). While participants in that study did not rate place similarity highly compared to other attributes like interests and friends, their participants were limited to people on the same university campus, which could have made location information less valuable. Identifying whether location might be interpreted differently outside of a university campus is part of the current work.

Another potential mechanism for building social capital through location awareness is mere-exposure. The mere-exposure effect suggests that people prefer objects based on the frequency with which they are exposed to those objects (Zajonc, 1968). Awareness of locations that are popular for a community could potentially lead people to visit those places with higher frequency, therefore being exposed to other community members more. Accordingly, previous research showed that common spaces in buildings facilitate social engagement in a community app (Dillahunt and Mankoff, 2014). Increasing the frequency of exposure to others in one's community could facilitate relationship progression through Grannis' stages; these relationships could serve as resources to the individual, thereby increasing social capital. Despite the potential for location

tracking data to be used for community-building, it has historically been primarily utilized instead by companies.

2.5 Current Work

The previous literature covered shows how public and private have become separated, leading to modern-day isolation in cities. Despite people's proclivities away from socialization, there are benefits from urban connections. Technology has been shown to blend public and private in ways that encourage urban interaction, and through this research I explore how location information, a rich social cue, could be used to intersect public and private realms. I aim to gain a deeper understanding of how *LBPHD*s, location-based, post-hoc data applications, can be used for social benefit in urban areas. By providing private location information in a public but safe way and creating selective exposure to a community, this research explores if location data can be used to increase awareness and eventually social connection between members of the same community.

CHAPTER 3

SHARED LOCATION INFORMATION: A CASE STUDY OF HAPPN

In the previous chapter, we reviewed the historical development of urban life that caused public and private life to separate, but also the promise of technology to blend these two spheres in a meaningful way. Of particular note was location awareness and how it might influence community. In this chapter, we explore how location data is interpreted as social information through a case study of a dating application, happn.

happn (all lowercase) is a location-based mobile dating application that uses the overlap in two individuals' location histories to connect people and motivate them to meet. happn uses location history automatically captured by the mobile device to show users how many times their location overlapped with potentially matching individuals, and exposes the most recent such overlapping venue for each. happn's location sharing model extends the recently popular location-based, real-time dating applications (LBRTD) (Blackwell et al., 2014; Handel and Shklovski, 2012). LBRTD systems like Tinder and Grindr are based on matching individuals who are *currently* in the same location, supporting "local and immediate" matching (Blackwell et al., 2014). In contrast, happn is a *LBPHD*: a location-based, post-hoc data application, as matches are based on historical overlaps. We broaden the 'D' in LBPHD from dating to data since we are interested in the interpretation of location information beyond dating applications as used elsewhere in the dissertation.

The use of location history in happn is interesting because it provides built-in warranting against misrepresentation of personal information. Self-presentation plays a large role in dating services (Ellison et al., 2012; Hancock

et al., 2007) where a user's profile is expected to be a *promise* that a person would not be fundamentally different from the way that they were representing themselves online (Ellison et al., 2012). However, given that dating profiles can be easily manipulated and subject to selective self-presentation (Hancock et al., 2007; Toma et al., 2008), individuals on dating sites engage in uncertainty reduction (Berger and Calabrese, 1975) and uncertainty management (Brashers, 2001) to support their needs and goals (Gibbs et al., 2010; Corriero and Tong, 2016). Uncertainty Reduction Theory posits that when people first meet, they strive to make the interaction more predictable (Berger and Calabrese, 1975). In online dating, in particular, people who have greater security concerns and higher self-efficacy about one's ability to be successful engage in increased levels of uncertainty reduction behavior (Gibbs et al., 2010). However, as Corriero and Tong have shown, experience of uncertainty on Grindr, a dating LBRTD application, is complex (Corriero and Tong, 2016), with individuals often showing a desire for uncertainty. We add to the findings of (Corriero and Tong, 2016) to show the implications of location history and overlap for uncertainty reduction in LBPHDs such as happn.

Warranting plays a major role in constraining the degree of manipulation in self-presentation (Walther et al., 2009; Walther and Parks, 2002). As Walther et al. put it, "Warranting refers to the capacity to draw a reliable connection between a presented persona online and a corporeally-anchored person in the physical world" (Walther et al., 2009). As a result, when someone is making a claim on their profile (an otherwise unreliable conventional signal according to Donath's signaling theory (Donath, 2007)), the presence of social connections acts as a warrant and can constrain the degree of deception, implying that "they have vetted this description as true" (Donath, 2007). Researchers had pro-

posed a system using warrants for verification of dating information, validating posted information against Facebook (Norcie et al., 2013), a mechanism similar to what several popular dating apps (Tinder, Bumble, Hinge, and happn) use nowadays. These applications require Facebook accounts to log in and sync name, age, occupation and sometimes photos from Facebook rather than allowing the user to edit directly in the app. In addition to the warrants from the presence of social ties, users of dating sites could also engage in other strategies, such as searching for a particular user on Google (Gibbs et al., 2010) and check the consistency of the claims being made. Given the importance of warranting to online self-presentation, in particular in the context of dating where misrepresentation is possible (Hancock et al., 2007; Toma et al., 2008), we investigate the role of location history as a new warranting mechanism in the experience of happn users.

In addition to warranting, similarity is another key mechanism for both uncertainty reduction (Berger and Calabrese, 1975; Gudykunst, 1985) and enabling social connections through homophily. As covered in Chapter 2, homophily, colloquially referred to as "birds of a feather" (McPherson et al., 2001), suggests that individuals are likely to have affinity towards others who are like them. However, we do not fully understand the mechanisms through which this similarity is perceived and evaluated. For example, whether the frequency of overlap alone would be enough to establish a sense of similarity, and how individuals derive and estimate similarity from this information in the context of dating. Such understanding can provide key insights for system designers to rethink what information they could present to users to minimize privacy concerns (Blackwell et al., 2014) while still providing value.

System-driven warranting like the one provided by happn is likely to be increasingly prevalent with personal devices, sensors and applications increasingly integrated into our lives. Under such a scheme, information is 1) collected and provided by an automated service, 2) reflects the identity of the individual, and 3) is not likely to be manipulated by any person. More specifically, in happn, personal location traces are collected by a mobile application and made available (in the form of overlaps with others) in a manner that is not easy to manipulate, hence providing at once potentially-meaningful information about the individual (Schwartz and Halegoua, 2014), and warranting for this information.

Using the post-hoc location overlap information, the experience of individuals using happn is likely to be very different than the "proximity-based co-situation" experience of LBRTD systems like Grindr (Blackwell et al., 2014). In this work, we perform a series of semi-structured interviews with happn users to provide a better understanding of the experience of users of LBPHD services. In particular, we are interested in the value of the warranted location overlap information, and aim to address the following research questions:

RQ 1. *How do people make sense and use information about location overlap when evaluating potential romantic partners?*

RQ 2. *What new benefits and drawbacks does location overlap information offer for dating applications?*

We discuss our results in the context of Uncertainty Reduction Theory (URT) that suggests that strangers looking to communicate will seek to reduce uncertainty in various ways (Berger and Calabrese, 1975). URT had been applied

to web-based dating sites (Gibbs et al., 2010) and LBRTD services (Corriero and Tong, 2016). The dynamics of these new LBPHD services, and more generally, of system-warranted information, are likely to produce new uncertainty reduction dynamics and practices. Our findings have implications for designing systems that seek to enhance the social awareness in physical spaces using location overlap information. Such applications for "hybrid placemaking" are not limited to online dating, and can extend to other settings and applications.

3.1 The happn Application

In this work, we examine happn, a location-based post-hoc dating application (LBPHD). happn is different than location-based *real-time* dating applications such as Tinder, Bumble, and Grindr: these applications mostly use geolocation to match to people that are nearby at the same moment. The happn app, on the other hand, adds a temporal dimension to location, and uses the location history to present users with how many times their location overlapped with potential matches *after* the occasion in which they overlapped. Launched in early 2014, happn is a French-based start up. As of Jan 2016, happn reported having 10 million users.[1]

There are two types of location overlap information that happn makes available to users, both shown in Figure 3.1. First, happn shows the number of *crossed paths*: how many times the individual using happn has overlapped in locations with others using the app. In happn, location overlap is defined as when two individuals are within 250 meters at the same time.[2] The app tracks users' ge-

[1] http://techcrunch.com/2016/01/19/dating-app-happn-reaches-10-million-users-adds-voice/

[2] according to the application's official website description, https://www.happn.com/en/faq (retrieved: May 2016)

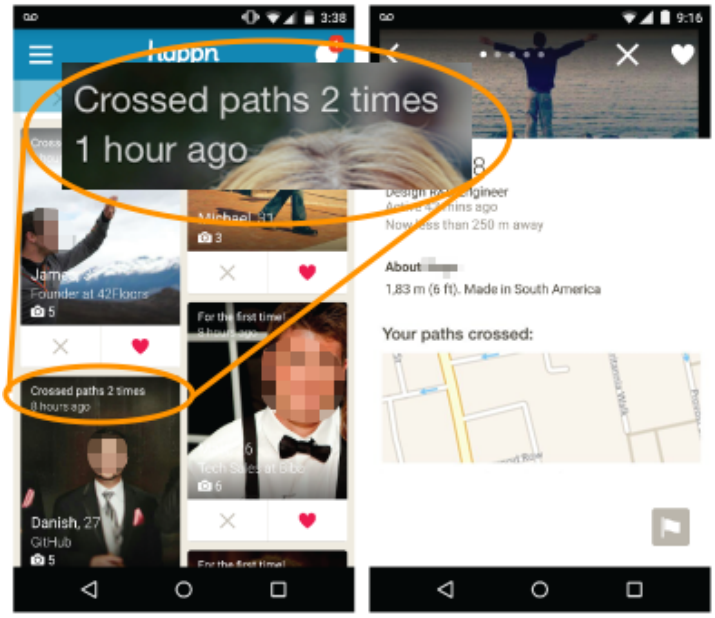

Figure 3.1: Landing page for the happn app, where users can see how many times they crossed paths with someone (left) and profile page with map displayed showing where a potential match crossed paths (right)

olocation through their mobile devices to find other individuals with whom the user has "crossed path", and displays their profiles in the user's feed. The number of crossed paths is displayed on top of the other individuals' profile pictures in the feed, which is the main page of the app as shown in Figure 3.1. Second, happn shows a *recent place*: a mini-map showing the time and location of the most recent overlap is available once the user taps on a profile, also visible in Figure 3.1. These two features of location overlap information are the novel design features of happn. Note that while building on detailed location tracking, individuals do not surrender their complete location history to others; only the most recent overlap, and an aggregate count of all the other overlap occasions are shown.

The interaction flow of the happn app is quite simple, and mimics other

popular dating applications. A user logs in to the happn app and creates a profile by uploading pictures and writing a short bio. Then the user can see the profiles of other users and filter by gender and age in a feed. A user can see the detailed profile information noted above by tapping on another user's profile picture. To interact with users that appear in the feed, a user could click on a heart-shaped button to indicate that they like the other user. If two users like each other, the app sends both an alert for a match, after which they could start messaging through the app. A user can also send "charms" to others. In this case, the "charmed" user will receive a notification regardless of whether they liked the other user or not.

3.2 Method

We designed a semi-structured interview protocol and used social media and snowball sampling to recruit participants who have used the happn application for more than a month. Broadly, the interview protocol asked participants about the basics of the application to elicit their understanding of how the app works, the information they pay attention to when using the app, their interpretation of the number of crossed paths and the recent place mini-map, the difference between crossing with people once versus a larger number of times, and whether they had ever seen someone offline that they had met on happn. For the full protocol, see Appendix A. Finally, the participants were asked about whether they use other dating apps, and the key differences between happn and those apps.

We recruited participants by posting on social media, such as Facebook and

Twitter, and on Craigslist. We also used snowball sampling: at the end of each interview, we asked the participant to put us in touch with other users of the app who would like to be interviewed if the participant knew any. The interviews were conducted by two of the authors through Skype or Google Hangout with voice recording between August 2015 and February 2016. The recordings were transcribed by a commercial transcription company. The interview protocol was approved by an Institutional Review Board (Protocol #1508005747). Each participant was compensated $10 for the interview that lasted approximately 30 minutes.

Two of the authors reviewed and coded the transcriptions independently, before the same two authors compared codes. Similar codes were merged and themes were extracted. Themes were further refined by all authors during the sense-making writing process. The unit of coding was discourse segments that pertained to the same topic (could be a single sentence, several adjacent sentences, or a paragraph). The coding was done in a serial fashion, with each coder coding all responses from one participant before moving on to the next. The disagreements between coders were resolved through face-to-face discussions, with each coder explaining the reasons for his or her own codes and everyone agreeing on one.

A total of 15 people participated in the study, with reported ages between 22 and 42; eight were male and seven were female, residing in four different countries (most of the participants live in the U.S., two in Brazil, one in France and one in the UK). Only two participants were recruited through snowball sampling. One participant reported meeting her current significant other through the application. We summarize the demographic information of participants

in Table 3.1. The reported duration for using the application varied from two months to a year, and reported frequency of usage varied from checking the app every hour to once every other day. Most participants heard about and downloaded the application through word of mouth.

ID	Gender	Age	Location	Occupation
F21	Female	early-20s	San Francisco, CA, US	College student
M22	Male	22	California, US	Software engineer
F23	Female	23	Lansdowne, Mass, US	–
M24	Male	24	Brazil	Student
F25	Female	25	New York City, US	Account manager
M25	Male	25	San Francisco, CA, US	Tech
M26	Male	26	Paris, France	Entrepreneur
M28	Male	28	Berkeley, CA, US	MBA student
F30	Female	30	California, US	Local health system
F33	Female	mid-30s	London, UK	Tech entrepreneur
F34	Female	34	New York City, US	Designer
M34	Male	34	Southern Brazil	University teacher
M38a	Male	38	New York City, US	Research scientist
M38b	Male	38	New York City, US	Security consultant
F42	Female	42	New York City, US	Founder of dating app

Table 3.1: Demographic Information of happn Participants

3.3 Findings

The main themes from our interview analysis can be organized into three main areas, following the interview themes and research questions. First, we look at how users interpret the location overlap information, the number of crossed paths and the most recent place, available from happn. We then show how this information is appropriated by users for various uses. Finally, we show the relationship between online and offline interactions and encounters that are enabled through the app.

3.3.1 Interpretation of Location Overlap Information

Recall that happn shows users the number of "crossed paths" they have with another individual, and a map of the most recent place where they crossed path with that individual (see Figure 3.1). Overall, as we show in this section, our participants used this data in various ways to extrapolate information about the other user. The location overlap information, even when represented as a broad map and simple count, provided perceived similarity between users. At the same time, the recent place map could imply either positive or negative potential for matching, depending on the location.

Inferring Similarity

Participants reported noticing a wide range in the number of crossed paths with others on the app, from one to several hundred. For some, the number of crossed paths was a proxy for similarity. M24 described, *"I'm much more likely to talk to a person that I crossed paths 20 times, because we are in the same place. We have similar habits and it's more likely for me to feel safe and for her, too...By the places that I go, by the place where I work at, by the place where I study at, the people who are in those places they are more likely to be alike."*

F25 indicated a *"golden zone"* of having crossed paths five to ten times. *"Less than that, I think it's just chance. They could have for two or three days gone to their friend's apartment in the East Village. More than that, it's because we probably worked in and around the same place."* M26 explained, *"I saw her maybe five times via the app. So, maybe she's working around? Or maybe she's living around my place."* As a result of inferred similarity from crossing paths, people used happn to *"find*

people that are actually in the same places, or about the same places that you are. That go through the same streets, hanging around the same places that you do, and this feeling is nice. (M24)"

Meanings of Different Locations

Beyond the number of crossed paths, participants reported extracting meaning from the happn feature showing the place where the most recent overlap occurred. M28 suggested that this location information on happn might be more truthful than other profile information; In contrast to the fact that *"everyone clicks foodie as a tag on their Hinge,"* M28 argued, *"the happn version of it actually would be better, to see that they actually go to that place."* For example, crossing at a touristy area could indicate that a person does not have long-term potential. F21 said, *"In a touristy area, they are probably a tourist, so I probably would never see them again. Or they work at the tourist spot. If it's a cafe, I'm pretty sure they are a regular so I would be more likely to see them again."*

These crowded areas also carry less meaning than unique venues that indicate interests. M34 explained that since he lived downtown close to a bus stop, *"People are passing around all the time…Everyone crosses paths around here."* The meaningful locations tend to be the ones that indicate a person's hobbies and lifestyle. F34 described how an infrequently visited area could reveal a specific interest. *"Because the climbing gym I go to is in Long Island City and, especially at night, there's not really a lot happening in that area, so if that's where our paths had crossed I'd be like, 'Oh, maybe this guy climbs'…"* Another participant indicated that the specific venue itself was not as important as the category of the venue. *"I'm seeing it as the activity of Tahoe is go skiing, the activity of Napa is go wine tasting*

as long as [you] know that they went to a winery and you went to winery, you don't actually need to know that you were at the exact same winery. (M28)"

The uniqueness of a situation could also be meaningful. F25 recounted, *"I was in deep Brooklyn. I went a warehouse party and I randomly opened happn on the subway…I saw that there was a person not far from me who I had [matched with], because I had walked to the venue and gotten dinner. I figured that they must have been in the area. I chatted with him a little bit and then at least I knew then that we had this weird, shared experience of taking the subway thirty minutes into Brooklyn."*

The time of crossing, such as in the morning or during the night, could reveal a diurnal pattern that was often meaningful. For example, as F34 described, *"If it was 11 o'clock and they were active, then I guess I was like, there's a chance that they were at home or they were walking to their apartment at the same time I was walking to my apartment. But you don't necessarily know that they could have just been going to a bar that's nearby."*

When Overlaps are Negative

However, not all crossings were perceived of as positive or at least neutral. Four participants indicated a hesitancy to match with people in certain locations, such as around where they live. F30 described this hesitancy as a desire to not *"wade in that territory,"* a sentiment echoed by M24 who said, *"If someone matches me when I'm at home, it would feel weird."* Several participants were particularly wary of matching with people that live in their vicinity because of their perceptions of their neighbors. *"The area that I live in is very residential and family versus downtown where I use it, there's a lot more my type of crowd. The folks that I*

would want to hang out with or go out with. (M25)"

Friends in Common versus Places in Common

A topic that arose during conversations with six of the participants was the comparison between location overlaps and overlaps in social networks (e.g. Facebook friends, a feature of Hinge, a competing dating app). While both applications provide a level of warranting and verification to users, they did so in different ways. F25 said, *"it felt safer with the checks with your Facebook, so [the app] verifies person and had to be friends through Facebook which I thought was pretty secure."*

Comparing Hinge and happn, M25 said that having a friend in common is *"a closer connection"* compared to having a location in common. He explained,*"Your friend can give you input or can be like, yeah, I think that'd be a good person to go out with or have a drink with. . . Hinge is the most qualified, then happn just because you're in the same area, and then tinder, where you have no idea who the person is."* M28 also thought that friends of friends was a greater signal for similarity than location overlaps when he said, *"I find that I have more in common with the people that I'm matched with [on Hinge]. I feel like with happn, it's really anyone that's come across your path. For example, in a town like Berkeley, yes there are more students, but there's also just people from all walks of life doing all sorts of different things, and you don't necessarily see as much information about them."* However, relying on pre-existing network connections can present its own challenges, the limited coverage for example, or like F42 who lives in New York City said, *"the problem with that one [Hinge] is that some [of] the friends of my friends live in Australia and I'm like, 'Okay, that's not gonna be fun'."*

3.3.2 Appropriation of Location Overlap

Location overlap data allowed users to learn a variety of information about a person of interest and assess similarity, but it was also useful to enable smooth interactions later, including allowing people to assess the convenience of a potential meeting, and providing a source of common ground.

Convenience

In part because of similarity, location overlaps also indicated if someone might be convenient to date. A higher number of crossed paths was necessary to infer convenience; otherwise, people had more difficulty interpreting whether a potential match worked or lived near them. F42 explained, *"When you see somebody 90 times on happn, they clearly live near you. So, that could be a good thing if you want a convenient person to date. You don't have to spend money taking a cab to go see them."* M26 expressed a similar logic, *"It's easier for us to have lunch because I know where you're going to have lunch, and I know that you're working maybe around my place."*

Common Ground

Location overlaps could be a source of common ground to be used as a point of discussion when messaging someone of interest. Six participants mentioned using the map in messaging conversations. M25 explained, *"most of the conversations have been based on the pretense of the app itself. It's like 'oh, I was just at this place. It's really interesting that we didn't bump into each other, but hey, we're*

on happn.' That's usually a good conversation starter because we have something in common."

M26 found that location overlaps provided a broad range of topics that could be used to facilitate conversation.*"You can have a different approach about talking to her, and you have more common point about the fact that you can talk about your city, or the area, the neighborhood, or maybe we have friends in common, or maybe we are going out at the same place around the neighborhood, or where you work...so it puts some more points, some more key points and common points than somebody you don't see and that is living far away."*

F34 provided another example of how a particular location overlap could lead to conversation. *"Let's say we went to the same concert. I'd be like, 'Hey did you like that show? What other music do you listen to?"* Even ambiguity in location overlap prompted a conversation for M38b. He recounted, *"She works for another company that is adjacent from our building so in conversation we were asking each other where we could have possibly crossed paths like if it could have been in the doughnuts over there or if it's at the diner."*

None of the participants mentioned using the location overlap information when meeting a date in person, potentially suggesting that its utility was primarily for initiating conversations through the app, although it is possible that the topic did not arise as our interviews' main focus was on app-based interactions.

3.3.3 Online Meets Offline

The temporal and geographic overlaps presented by happn allowed for the possibility that users would see one another "offline", without planning to do so. Such encounters served as verification that the person matched his or her profile, but also led to privacy concerns and awkward social situations.

Seven out of the 15 participants indicated that they recognized someone (ranging from one to five people) from the app in real life. The app surfaced people that otherwise may never have been noticed. As M25 explained, *"it's just interesting that you could cross paths with someone like eight or nine times and never really even see them or realize that that's them."* The frequent encounters without further interactions can be viewed as a type of "familiar stranger" (Milgram, 1974).

Because the signal that happn provides is a combination of offline and online, M26 felt a sense of "trust" that *"you can find out if it's real or not"*, which is difficult to establish when the interaction initiates online. M26 explained, *"it was the fact that you can recognize people on the street and maybe before chatting, you already see them and it's better than the other app because it puts some more human thing in the application...But happn gives you the sensation that it can be real...because maybe you can walk on the street, you see somebody and you open the app. You can also see her on the app."*

At the same time, this very mechanism could also compromise the safety and privacy of users, a topic discussed by six of the participants. M34 said, *"From where I live there's a bunch of people that work nearby, that study nearby, and if I wanted to I could easily follow them."* M38b also echoed the possibility of being

followed, *"say you encounter a stalker or something and the next thing you know he knows where you're eating, he knows where you shop and everything."*

The privacy concerns of two participants were rooted in their real experiences. F33 recounted seeing someone in the app and then passing them on the street, leading her to describe the app as *"a little bit stalker-ish"*. M24 explained how he had "liked" a girl in the app when he heard her react near his vicinity. *"I looked around and there was the girl inside my classroom. It was freaking scary."*

F30 summarized this dichotomy by referring to the application as a *"cool stalker app,"* explaining that *"If you think about it, like I know who lives across the street even though I've never met him and I know what his hobbies and his likes and dislikes are all from this app. So, I mean, that part of it is kind of weird, but it's also kind of cool because you could see who has the same interests as you in terms of where you like to go or where you like to eat."*

Another privacy complication of the happn location-based interaction was the high likelihood of context collapse: encountering a profile of someone you know in work settings, or other professional or social settings that is often perceived as incongruous with dating. Unlike Tinder or similar apps that are only used on demand (and still demonstrate context collapse issues (Blackwell et al., 2014)), happn by default shows overlapping paths that are highly likely to include work or home locations. As a result, five participants described "in-app recognition" of people they already knew from other settings. Such encounters were usually described as "weird" or "awkward," contrary from the experience that the app has attempted to create. Many of the recognized users were coworkers or classmates with participants, and it is considered an embarrassing situation when users see people that they know in other contexts.

M34 described how he matched with a future co-worker in a school. *"We actually matched on the app and got to meet on [the] first week of school. It was very weird."* He went on to explain, *"We talked a bit on the app but it didn't work out. We did not talk that long. And on first week of school, all teachers together, I looked to the side and, 'Oh I know that girl.' And she looks at me and kinda looks like, 'Okay I know that, but no I'm not gonna talk to him.' And I was not really in the mood to talk to her as well."*

M22 explained how the norm is to *not* openly acknowledge this recognition when matched with someone you know. *"There's sort of an unspoken rule that if you see someone on a dating app, you don't mention it to them in person"*, consistent with the idea of maintaining privacy through contextual integrity (Nissenbaum, 2004). F21 echoed the norm of disregard with her experience when matched with other students. *"Sometimes I'll see that I passed someone I know on the app and then we happen to be in the same class. He's never said anything and I've never said anything, so it's that mutual not talking part."*

3.4 Discussion

We relate our findings to multiple facets of Uncertainty Reduction Theory (URT). Central to URT is that "when strangers meet, their primary concern is…increasing predictability about the behavior of both themselves and others in the interaction" (Berger and Calabrese, 1975).[3] As we mentioned above, URT has been used in the past to discuss and reason about online dating (Gibbs et al., 2010), including location-based real-time dating service Grindr (Corriero

[3]A more recent theory of uncertainty *management* expands on URT with introducing the idea that individuals may *desire* uncertainty at certain contexts.

and Tong, 2016). Our findings suggest that happn, with the dyadic location overlap exposed by it, creates somewhat different URT dynamics than other dating systems.

The warranting power of the location overlap data in happn plays a major role in reducing uncertainty. Previous research cited "concerns over misrepresentation and deception" (Gibbs et al., 2010) as a major factor in the need for uncertainty reduction in dating sites. This concern was also the one most cited by Grindr users (Corriero and Tong, 2016). In our interviews, though, such concerns were very limited, an outcome we believe is due to the high warranting value of the location data. Warranting refers to the ability to evaluate or validate the information presented in an online profile (Walther et al., 2009). Traditionally, and especially in dating sites, reliance on self-presentation is prone to profile misrepresentations, and profiles are perceived as such (Hancock et al., 2007; Gibbs et al., 2010). However, individuals "privilege messages that cannot be manipulated" (Walther and Parks, 2002), or, in other words, high in warranting value. This issue was directly addressed by M28 when he compared the truthfulness of the location overlap information in happn to tags people use on Hinge. Our participants perceived the happn location overlap as an honest signal, and as a truthful representation of identity. Concerns about misrepresentations were not raised. In Donath's terms, the location overlap allows individuals to rely less on conventional, easy-to-fake signals, and was treated as an assessment signal that people take on its merit (Donath, 2007).

The hyperpersonal model of communication (Walther, 1996) seems to play a role in how individuals on happn, as message receivers, interpret the location overlap information. The hyperpersonal model predicts that message re-

ceivers will tend to exaggerate perceptions of the message senders, make over-attributions from minimal cues, and fill in missing information (Walther, 1996). In particular, the model predicts that contextual cues will be used to find similarities to sender, for example, group identification and personality match — a prediction that aligns very closely with what participants reported in the interviews (e.g., F34's climbing gym experience quoted previously). It helps, of course, that location information such as neighborhood and venues are known to reflect (and be interpreted as reflecting) personality and social cues (Mehl et al., 2006). It is clear that certain location cues provided by happn will have much higher signaling value than other such cues, based on the qualities of the location and dyadic information (uniqueness, number of crossings, context, etc.). Note that the receiver interpretation is happening even when senders are not able to craft their message as is normal in CMC settings and predicted by the hyperpersonal model (Walther, 1996; Walther, 2007).

Not unrelated, similarity is another concept that plays a significant role in uncertainty reduction, and was suggested as one of URT's "axioms" (Berger and Calabrese, 1975). Individuals on happn have various rules and mechanisms for deriving similarity from happn data. Those mechanisms often exhibit explicit homopholous tendencies (see M24's quote above about people "more likely to be alike") (McPherson et al., 2001). In some cases, individuals estimated similarity from the recent place map. In other cases, individuals were estimating similarity by the number of crossed paths.

Reciprocity is another "axiom" of URT (Berger and Calabrese, 1975), and holds that high levels of uncertainty produce symmetric levels of disclosure where individuals "ask for and give the same kinds of information at the same

rate of exchange". Unlike other dating apps where users "consider the risks of sharing such information with strangers absent confirmation that others are being honest in their disclosures" (Gibbs et al., 2010), happn builds symmetric disclosure right into the user profiles: the location overlap. On the other hand, such built-in disclosure mechanism might break the chain of self-disclosure begetting more self-disclosure, as described in previous research (Gibbs et al., 2010).

Security concerns are known to play "the greatest role in influencing uncertainty reduction behavior" as was found in a general dating survey (Gibbs et al., 2010), though more recently security was *not* tied to a desire to reduce uncertainty in Grindr (Corriero and Tong, 2016). It is likely that happn may reduce such concerns by the nature of information available, though our participants certainly still voiced security considerations. A related risk of recognition, being identified by someone who knows you, is perhaps even heightened in happn compared to other dating applications. It is well documented that, in dating systems, individuals are concerned about having profiles recognized by known others, such as friends, family, or work colleagues (Birnholtz et al., 2014; Blackwell et al., 2014; Couch and Liamputtong, 2007; Gibbs et al., 2010; Corriero and Tong, 2016). Such risk is greater in location-based dating applications (Corriero and Tong, 2016) where the chance of encountering known people around you is higher than in online browsing of profiles, and was even higher with happn as we show above.

Our findings indicate that location overlap cannot fully replace the common mechanism for warranting via shared social network. Network-based warranting posits that information posted on an individual's Facebook page, for example, cannot be easily faked (Donath, 2007; Walther et al., 2009): the presence of

other friends makes it unlikely for an individual to post deceptive content. Our findings show that the warranting value of location does not quite achieve a level of uncertainty reduction that could be achieved via common friends. On the other hand, the *potential connections* made through location overlap are much more widely available (as the likelihood of friend overlap with other individuals is not as high), and does provide non-trivial value.

A major assumption of URT is that strangers engage in exchange that is geared towards removing friction of future communication (Berger and Calabrese, 1975). In the case of happn, our findings show a number of ways in which friction is reduced: participants talked about drawing conclusions about convenience of meetings, and discussed using the "common ground" from the location overlap information as a discussion topic and conversation starter when they first converse. Thus, the information available from happn is richer and allows for more uncertainty reduction than dating apps like Tinder that do not provide overlap, instead requiring real-time interactions around the location without much context.

This work has implications for "hybrid placemaking" – designing for places "where its digital and physical space equally contribute to its perceived values" (Bilandzic and Johnson, 2013). While we investigated crossed paths in the specific context of dating, such location overlap information has the potential to be used in other settings. This information, as a link from the physical to the digital world, can be used to increase the awareness of others who are in the same physical space, as well as facilitate collaboration and social encounters. For example, the popularity of Pokémon Go, an augmented reality game that tracks location, is a platform that further social applications could piggyback

on (e.g. match players based on the the number of same PokéStops they have been to.) In other scenarios, residential or office buildings could install ambient displays as a lightweight way to increase the awareness of residents or tenants in the building, who frequently cross paths with each other but do not interact.

Finally, our findings may offer insight towards building tools that support establishing trust between users in social networking sites and services. We have shown that implicit signals such as tracked location history are perceived to be more honest and less prone to manipulation. As more and more social systems facilitate offline social exchanges, often forming a marketplace, such as Airbnb and Uber, it is important to consider strategies to ensure the accurate representation of identity as well as the perceived trustworthiness of other users. Warranting, implicit signals, and system verification are strategies that we observed in happn that can contribute to higher trust, and could prove meaningful in other settings as well.

3.5 Limitations

This research is not without its limitations. By choosing to interview participants, we prioritized depth of information over generalizability of our findings. While we attempted to recruit a diverse set of interview participants, many of our participants were from the coastal United States, potentially leading to cultural bias in our results. Previous research on cultural differences in use of social network sites suggests that such differences may also exist in online dating app usage (Ji et al., 2010). In addition, the self-selection bias in our sample of users may distort our findings, for example as those that agreed to be interviewed

could also have more open personalities. Similarly, relying on snowball sampling could have limited the type of users that we spoke to. Our method of interviewing relied on self-report, and as dating can be a private subject matter to discuss, participants may not have disclosed all of their relevant past experiences.

Our qualitative, self-reported approach may have missed behaviors that could be more easily gleaned from data. For example, it is possible that people turn on and off location services, or temporarily disable location tracking in order to hide their location or control what is visible to others. Understanding whether such behavior exists, or the magnitude of such behavior requires access to log data, and is left for future work. Other open questions include how much such agency may impact the perceived value of the logs by other users, or more generally, how to balance the need for agency and control on one hand, with the usefulness and warranting effect of the data on the other.

3.6 Conclusion

Building on interviews with users of the mobile app happn, we investigated how individuals interpreted and made sense of crossed paths signals: the location overlap between two individuals using the application. We show that this type of information allows people to reduce uncertainty in various ways that expand on other dating apps. The warranting aspect of location information – the fact that it was viewed as something that cannot be easily manipulated – helps making it into a more potent signal. Nonetheless, it is important to consider that as a greater number of applications leverage location data, the ethics

of how this information is disclosed is a growing concern (Iachello et al., 2005; Consolvo et al., 2005). Ensuring user's privacy and personal safety, potentially through aggregation and anonymization, is an important consideration. Finally, based on our findings, we offer the potential for utilizing location overlap information to develop platforms for facilitating social connections in other contexts. This research served as the basis for designing our own app that uses location overlaps for communities instead of dating, which I detail in Chapter 4.

CHAPTER 4

DESIGN AND PILOT STUDY OF MOVEMEANT

In Chapter 3, I described the promise of location history overlaps for interpersonal relationship development that we found from interviews with happn users. Based on these findings, we developed our own app, MoveMeant, which similarly utilizes passive tracking of LBPHD and highlights location overlaps, except for community building. We decided to develop the app in order to understand how the information provided by this kind of technology is interpreted and used by people. Following, I explain how we arrived at the design of MoveMeant and the results of a pilot deployment in the Bronx.

As explained in Chapter 2, social capital, weak ties and local connections have long been linked to prosperity and resilience at the individual and community level (Tompson et al., 2013). Such connections can lead to emotional and physical support, enhanced resource sharing, and even contribute to civic action (Ross and Jang, 2000). However, social connections have been elusive to create in dense urban environments.

Previous systems have been designed with the purpose of promoting local connections. These projects include commercial services like Nextdoor, social media designed for neighborhoods (Masden et al., 2014), Peerby,[1] a local peer-to-peer resource sharing site, and YikYak, an app for anonymous local conversation (Kang et al., 2016). Other systems encourage more brief interactions between people in public spaces, like pressing buttons at the same time as a stranger to hear a joke (Balestrini et al., 2016) or meeting someone in an airport matched through Twitter (Grevet and Gilbert, 2015). All of these projects re-

[1] peerby.com

quire active input from users in order to function successfully, which can affect the system's ability to grow and expand (**?**). MoveMeant differs from other hyperlocal social networking services because data is automatically collected from mobile devices, with potentially different social implications.

As we found from happn users, one channel to potentially stimulate social interactions could be through surfacing similarities between people. Similarity is known to lead to attraction in settings (Huston and Levinger, 1978) partially due to how similarity indicates other's future benevolence or compatibility. Constructural theory also suggests that similarity can lead to interactions given information of what individuals have in common (Carley, 1991). Location inferences, in particular, may stem from that fact that venues visited by individuals could be seen as a form of cultural production and taste, where similarities are known to help in forming and sustaining weak and strong ties (Lizardo, 2006). These findings suggest the potential of location data to create local awareness and ties.

Several systems have employed location information for social sharing, both through active checking in and passive data collection. By checking in on Foursquare and its predecessor, Dodgeball, users have contributed to a sense of commonality among people in a public space (Humphreys, 2007) and drawn inferences about local familiar strangers (Schwartz, 2013). Whereabouts Clock was a location-tracking system for families that showed the importance of *location-in-interaction*, the location information in context that provides value to others as opposed to its technical accuracy (Brown et al., 2007). Jabberwocky also used location information to indicate familiarity of a place based on the people who frequent that area (Paulos and Goodman, 2004). These systems

suggest the untapped potential of applying location tracking at a group level to build social awareness of local community.

To understand this potential, we created MoveMeant, a system designed to increase awareness through shared location traces in a local community such as a building or small neighborhood. The MoveMeant mobile app collects location data on a user's smartphone. A server collects and aggregates anonymous community-level data about the venues people visit, and exposes the data to users in the community. Further, MoveMeant allows users in each community to opt into interaction around specific venues. The awareness in MoveMeant is designed to increase perceived similarity, potentially leading to increased affinity and ties as described above. One strong design consideration was privacy, a known concern especially with location data (Beresford and Stajano, 2003). First, MoveMeant, like Eyebrowse (Zhang et al., 2016), a Chrome extension that shares web-browsing history with friends, is based on *voluntary* sharing of information instead of involuntary surveillance. Moreover, MoveMeant is using anonymity and non-persistent user identification for aggregating the location data. In other words, by design, even the MoveMeant server cannot connect different venues visited by the same user, yet is able to produce community-based aggregate patterns.

In this chapter, we detail the iterative design process of MoveMeant and its exploratory deployment over a 6-week period in the Bronx to understand how key features of the app, anonymous aggregates and venue-based interactions, were used and received by a community in the wild. Based on interviews with residents, we report on how the system increases community awareness through dissemination of local knowledge and third places without compro-

mising user privacy.

4.1 Iterative Design Process

The design of MoveMeant followed an iterative process, refining the service based on the results from several small-scale deployments, eventually leading to the system whose evaluation is described in the next section. We begin by describing the higher-level goals of MoveMeant and how they were embodied in the first prototypes, and summarizing the results of the initial deployments.

MoveMeant is designed to increase local community awareness through shared location traces, thus hopefully exposing similarity, leading to affinity and encouraging connections and ties. We had a number of design guidelines for creating the service. First, MoveMeant is designed for people in a small-size local community, for example a residential neighborhood, individual apartment building, or even large company office. Second, MoveMeant does not require continuous user-initiated explicit sharing; it is based on implicit and passive (thus easy and likely sustained) sharing. Further, user-created or any manual sharing of content is not even possible, except for revealing usernames, preventing abuse and discomfort known to occur in other local apps (Masden et al., 2014). Finally, MoveMeant does not require people to give up their de-identifiable location logs, as we explain below. Initial designs and flows are shown in Figures 4.1 and 4.2

To achieve these goals and guidelines, MoveMeant: (1) tracks participants' locations (venues visited) on their own mobile devices; (2) collects and displays anonymous aggregate community venue data; and (3) allows individuals

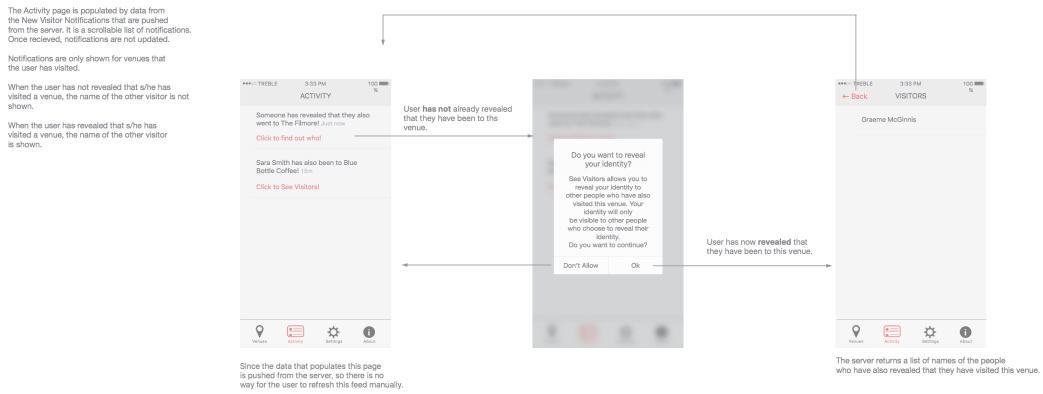

Figure 4.1: Flow for the reveal dialogue from a previous iteration of MoveMeant

to opt-in to reveal their username for a venue displayed alongside others who were there and opted-in as well. The userflow for MoveMeant and main MoveMeant screens are shown in Figures 4.3 and 4.4. For an individual, MoveMeant passively tracks their location and computes the venues that they have visited (their private logs) on their own mobile device.

Aggregate community data of venues visited by two or more people is shown in a dedicated screen within the app. In our initial implementation, the aggregate data was shown in a centrally-located community awareness display, but that visualization was eventually moved to the device as we explain below (see Figure 4.5). A MoveMeant user's private history screen shows how many people from their community have also been to the venues they visited.

In addition, users can opt-in to *reveal* their username to others who visited the same venue and have also opted in for that venue (shown in Figure 4.6).

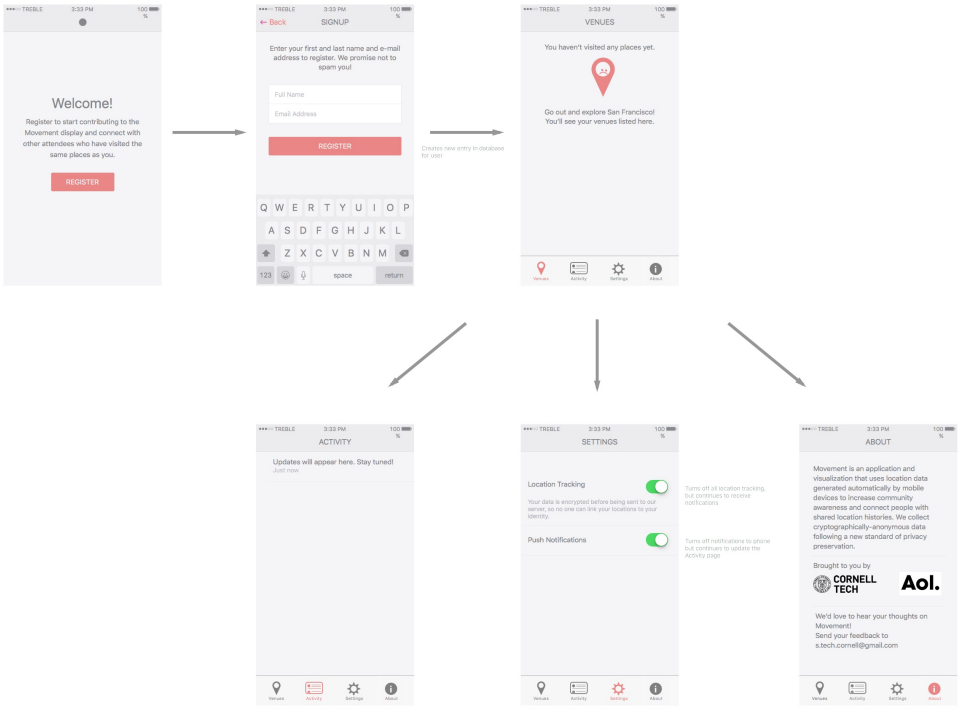

Figure 4.2: Flow for the onboarding experience from a previous iteration of MoveMeant

This process can be termed a 'group-opt-in' (similar to the 'double-opt-in' that exists in some dating apps, such as Tinder (Feuer, 2015; Masden and Edwards, 2015)). This is the only time potentially pseudonym identities are attached to a particular location on the MoveMeant server, and the only action that requires an explicit input from the user. This action will be referred to as *reveal* in the rest of the paper.

Because any kind of longitudinal location data can de-identify a user, we implemented MoveMeant with default anonymity *and* non-persistent identity. As

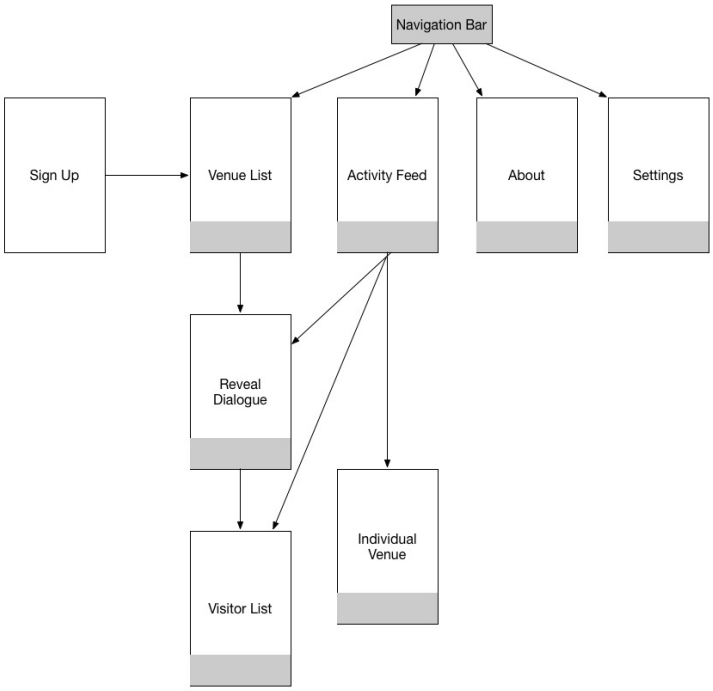

Figure 4.3: Userflow for the MoveMeant app

noted above, all data is aggregate and anonymous, and venues with fewer than two visitors are never displayed. Moreover, a user's private logs are stored only on their own device, and submissions are made such that the MoveMeant server 1) does not connect an individual to a submitted location, and 2) can never recreate a log of locations for a specific individual. MoveMeant demonstrates that we could make use of this often-sensitive data without compromising people's privacy, a benefit that could be further strengthened using anonymity-preserving cryptography techniques (Hohenberger et al., 2014).

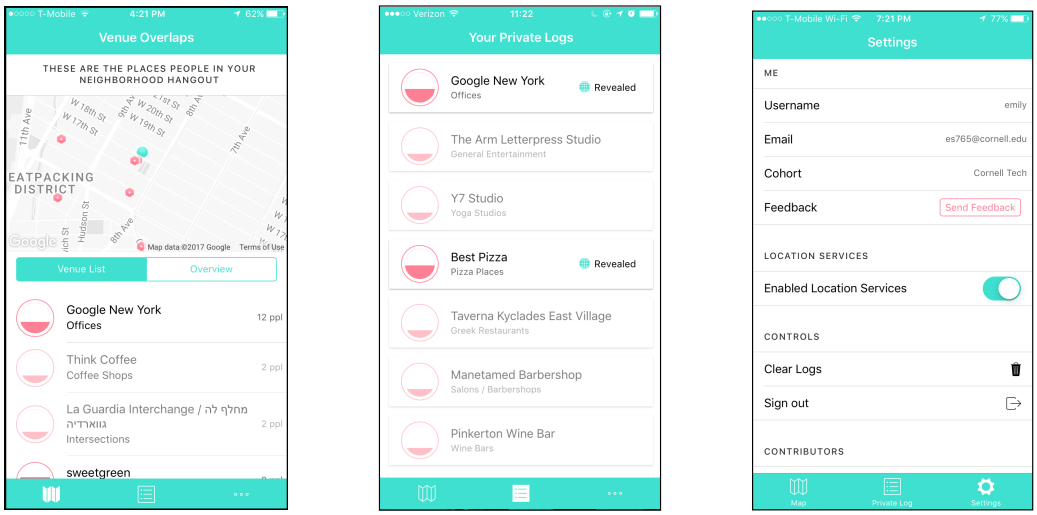

Figure 4.4: MoveMeant screens of the anonymous aggregate community venue data (left), private logs (middle), and settings (right).

Figure 4.5: Community-level information design refinement from a large display (left) to an email digest (right)

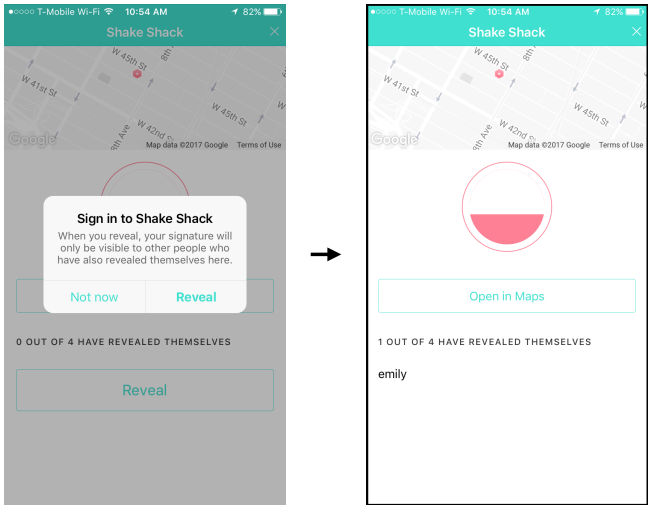

Figure 4.6: Flow of the reveal dialogue for an individual location.

4.1.1 Refinements from Pilot Deployments

Three exploratory deployments of MoveMeant were carried out: as an integrated demo at CSCW, an international HCI conference (described in a demo submission (McLachlan et al., 2016)); at Cornell Tech, a small urban university campus; and at AOL, a tech corporation based in NYC. The goal of these deployments was to refine the design and explore ways of keeping users engaged with the app to help enable future long-term deployments.

During the deployments, we explored two implementations for the aggregate awareness data. For the deployments at the conference and campus, a large display was used to show the aggregate community data. In a later deployment in the tech corporation, a weekly email digest was used to send aggregate com-

munity data to users. The goal of the public awareness display was to drive interest in the app with non-users in the community as a way of building a user base, as the display would necessarily be visible to both users and non-users. The weekly email digest was an alternative, used to explore a strategy that would be easier to deploy, as no hardware was required to be installed and maintained.

Feedback from pilot participants suggested that the information in the digest emails and public display was compelling enough for users to want to have more regular access to it, prompting us to create a dedicated "awareness screen" within the app to display the aggregate community data, (shown in Figure 4.4). This major addition to the app, as well as various other more minor improvements like improved location accuracy and reduced battery drain were implemented, and an updated version of MoveMeant was made available via the Apple App store, to be used in our final deployment.

ID	**Gender**	**Age**
M32	Male	32
M35	Male	35
M33	Male	33
M29	Male	29
F27	Female	27
M29	Male	29
F32	Female	32
M26	Male	26
F26	Female	26

Table 4.1: Demographic Information of Bronx Participants

4.2 Evaluation

Eighteen participants from the Bronx, New York used MoveMeant over a 6-week period between August and September 2016. This deployment aimed to understand how people might use shared location traces to gain awareness of their community, and how it might lead to connections and ties. We used a mix of convenience and snowball sampling to recruit participants who live in the Bronx, a low-socioeconomic area where the benefits of awareness, support, and connections could be high. Participants were compensated $10 for downloading and installing MoveMeant. In total, MoveMeant passively logged a total of 775 unique venues visits from the 18 participants. Users were active during the 6-week deployment, with an average of 92 weekly application opens (SD=20.02) with 10 average weekly active users (SD=3.22). Three users revealed their identity for 11 venues like buildings on a college campus, fitness centers, parks and restaurants. Other venues participants visited included pharmacies, train stations, and hospitals.

We recruited a subset of the users for semi-structured interviews, aiming to conduct interviews in two rounds, after two weeks and six weeks of deployment. Interview questions covered participants' feelings towards their neighbors, geolocation apps, and experience with MoveMeant. For the full protocol, see Appendix B. We performed interviews with nine users (three Female) ages 26-35 (M=29.8). Seven participants took part in the 2-week interviews and six took part in the 6-week interviews (four participated in both). Participants were compensated an additional $10 for each interview in which they took part. While we attempted to recruit more broadly, the MoveMeant participants, and especially those that agreed to be interviewed, were primarily students, though

all were long-time residents of the community having lived there for an average of 10.12 years (Min=4 years, Max=22 years). For a table of the demographics of the participants, see Figure 4.1.

Interviews were audio-recorded, transcribed verbatim, and anonymized and imported into Dedoose. Two researchers agreed on themes of anonymity/privacy, judgments about people and places and opportunities for social interaction. The themes were derived from the goals of MoveMeant and notes taken during the interviews. Two independent coders read through and analyzed the interviews based on these themes, which were then discussed by the research team.

4.3 Findings

The main themes from our interviews are reported below. In the text, participants are labeled to include their demographic information as 'Gender/Age', e.g. M35.

Our interviews uncovered that participants used the venue information from MoveMeant to discover places in their neighborhood and were more interested in revealing their usernames for locations where they might socialize, with some privacy concerns.

4.3.1 Place Discovery and Awareness

Six of the participants indicated an interest in using the app to find out about places in their area, particularly those that might be easily missed otherwise. While finding new places is a common feature of other apps like Foursquare and Yelp, MoveMeant does not require checking in or exposing one's individual identity. M35 described, *"There might be a mom and pop shop that I passed by... but you would never notice it otherwise. Things like that can be useful, 'cause there's a ton of things around here and you could kind of just go through them... You find out about it through somebody else's experiences."* F26 interpreted a supermarket with a high number of visitors to be one that might have superior products or sales. As M29 explained, aggregate community data can expose locations of special interest: *"On the outside it just looks like a regular building, but fifty people have been here in the past month. That would indicate that something's there."* F27 described how MoveMeant helped her to find a place she could not previously locate: *"There was a place that I wanted to go and I'd heard about it, but I wasn't exactly sure where it was at. I knew it was close by, but I didn't know exactly where. Actually I was able to find it on the app."* M26 suggested that seeing a place with a high number of aggregate visits that he was unfamiliar with could lead him to ask a neighbor about it to find out what it is.

4.3.2 Community Inferences

Instead of using location information to draw inferences about an individual person (Ma et al., 2017; Schwartz, 2013), MoveMeant participants made community-level judgments. Participants expected the aggregate data to reflect

the people in that neighborhood. F32 explained that the app could help provide information on if *"this area is more for hipsters, or more for college kids, or more for single people. Then it would be good too, because that way you're more...easy just to find people who are in more similar situations."* M35 expanded on how the locations could indicate the strength of a community when he said, *"If I'm looking at [zip code] and I'm noticing there is all these locations that are not in the area that are on this list, then my initial thought off the bat is maybe it's not a strong community, everybody is going outwards and not bringing anything back home."* Given the high elderly population in his neighborhood, M26 was surprised not to see the local community center in the aggregate community data. He also did not expect his college would be as frequently visited since most people that live in his area tend to attend community college.

4.3.3 Social Opportunity

Revealing for a venue carried social weight and was interpreted to mean *"that people actually want to meet someone there"* (F32). Participants were often interested in seeing the list of revealed people for public places like bars, but not ones that would be visited alone. M26 explained, *"I wouldn't give away [reveal] people like my dentist. People don't need to know which dentist I go to necessarily but definitely public places."* M29 said, *"I go there [gym] frequently so I'd like to see if there are other people in the neighborhood."* M35 described how he would be interested in using the reveal feature to find out about hyperlocal social groups. *"That would be perfect- to put a flag up and say here I am and I am interested in said group [flag football]."* However, F26 suggested that if too many people revealed themselves for a particular location, the long list might deter people from look-

ing at the individual names. She said, *"For anyone to sit there and look through 30 people…chances of them looking through it is really slim."*

4.3.4 Privacy

Privacy was a concern for users regarding certain features of the MoveMeant app. While selection bias may have deterred the inclusion of participants who were uncomfortable having their locations tracked, three interviewees brought up concerns around privacy. Revealing was perceived to have significantly more implications for privacy than anonymous tracking. For instance, F32 was unwilling to reveal for locations, with the exception of those with ample security. She described, *"This is my job. There's a lot of security, and a lot of ... surveillance. It's easier for me to do it [reveal] here than to do it at a bar or a lounge."* M35 was not willing to reveal himself in any locations, but was comfortable with tracking. He explained, *"It sounds personal because you know they're going to that exact spot, but not really because you don't know who it is."* M29 echoed the same distinction between tracking and revealing when he said, *"Especially if it's not being attached to me specifically but it's being seen anonymously then I don't have problem with that…If it's just saying, 'Someone using this app is at Pine Bar & Grill', then that's fine."*

4.4 Discussion

Our deployment of MoveMeant, and subsequent interviews and analysis, suggest the potential for MoveMeant to increase local community awareness

through dissemination of local knowledge and discovery of venues, with the possibility of building connections to neighbors.

4.4.1 Signals from Implicit Data

Our findings suggest the potential usefulness of signals generated from passively-collected, aggregate community data. Participants suggested finding the location information as a useful channel for gathering local neighborhood knowledge, learning about good and bad places in the neighborhood, as well as about the neighborhood more broadly. Importantly, since the data was anonymized, this information was not seen as breaching privacy, while still being able to provide a signal to others. As opposed to apps like Foursquare or Facebook that require explicit check-ins, MoveMeant relies on passive location tracking. Check-ins on other location-based systems are often performative, allowing users to show off that they were in a particular exclusive or special venue (Humphreys, 2007; Lindqvist et al., 2011). In contrast, MoveMeant also captures mundane venues like supermarkets and banks that would not contribute to a person's self-presentation and are not part of a constructed social identity (Schwartz and Halegoua, 2014), thus increasing the coverage of the collected data. By frequenting these types of locales, residents could further engage with people in their community. As Lofland explains, "In the city, owners of neighborhood grocery stores often act as the cement that holds the inhabitants together- introducing them to one another, providing a locale where they can meet, circulating the gossip" (Lofland, 1985). Venues that are not necessarily tied to one's identity could be considered a type of non-place, relating to other recent HCI work on building asynchronous community in non-places (Cran-

shaw et al., 2016). Similar to the location-tracking dating app happn, the data collected by MoveMeant was interpreted as an honest signal (Ma et al., 2017), in this case about a community.

4.4.2 Social Opportunity in Third Places

By identifying popular local venues, participants were able to use the location data from MoveMeant as a way of becoming aware of a neighborhood's third places. Oldenburg argued that third places, like cafes, bars, and gardens, are crucial to a community's social vitality since they "host the regular, voluntary, informal, and happily anticipated gatherings of individuals beyond the realms of home and work" (Oldenburg, 1989). Our work suggests that even though venues considered third places might be popular, there is currently no way to be able to identify whether one's neighbors are the people going there. Additionally, third places often have a low profile and are characterized by their regular clientele. MoveMeant helps to increase awareness of these venues which may not be surfaced otherwise. Other location-based mobile technology has also caused third places to evolve. In her case study of Dodgeball, Humphreys suggests that instead of having one location that acted as a third place, where regulars meet at one corner bar or cafe, the ease of coordinating with people allowed for multiple physical locations to become third places (Humphreys, 2007). As opposed to the formation of new third places, the aggregate community data of MoveMeant increased awareness of third places. The dissemination of knowledge about third places can help extend participation in community life for those not currently included. A sense of community has been shown to increase participation in venue-based technologies (Farnham et al., 2009).

Research on CoCollage, a place-based display installed in a cafe (Farnham et al., 2009), showed that people were more likely to join the system if they already had a sense of community at the cafe. Instead of enhancing third places for existing community members, MoveMeant has the potential to disseminate knowledge about third places to help extend participation in community life for those not currently included, as well as to aid new residents to identify these third places.

Typical third places like restaurants and cafes were also the ones that participants indicated the most interest in *revealing*, showing the potential for using this information and MoveMeant to create social connections. The flag football example given by M35 suggests that similar interests or shared hobbies could be surfaced by MoveMeant that might lead to future communication with neighbors.

4.5 Limitations and Conclusions

We designed MoveMeant, a system intended to increase community awareness through passive location tracking. Our findings from a 6-week deployment show that participants used the anonymized aggregate community data to make judgments about the people and places in their community, and were interested in revealing their identity for third places where there was an opportunity to connect socially. A key limitation of our study is the interview population. While we purposely attempted to recruit non-tech-savvy users of an underserved community, our final interviewees sample had a majority of students. Nevertheless, our findings may generalize to other demographics.

Further, future work will also explore the value proposition or dynamics that could lead to a wider adoption of MoveMeant. Indeed, such larger-scale adoption would allow us to explore how MoveMeant is used in communities of different sizes and locales, and measure its direct effect on local social connections over time. While MoveMeant was shown to increase awareness of third places, the extent to which community members are able to develop social ties to one another was not within the scope of the pilot study.

These limitations were addressed by conducting a deeper evaluation of MoveMeant's use with a variety of different communities. Expanding the type of communities studied and better understanding how MoveMeant could be used by local communities is the focus of Chapters 5 and 6.

CHAPTER 5

CHALLENGES FACED BY COMMUNITY LEADERS

In Chapter 4, we described the design of MoveMeant and a pilot deployment of the location-awareness app. Our pilot study provided initial insight into how people interpret location overlaps and suggested that the information could be valuable and potentially a source for social interaction. However, the pilot was limited to 18 users that were predominantly students which limited the generalizability of our findings. Also, by only interviewing users of the app, we had a limited view of the potential effects the app might have on the greater social fabric.

In Chapters 5 and 6, we conduct studies to gain a deeper understanding of how aggregated location overlaps might be interpreted and used by communities. Focusing on communities provides a higher-level insight into the effect of LBPHD beyond individual interactions. Chapter 5 provided the basis for the multi-site deployment of MoveMeant by developing a generalized structure of the issues that communities face that may relate to MoveMeant. We conducted interviews after the main development of the app in order to uncover how this technology might be used. Had we designed an app for communities after interviewing leaders, we may not have included LBPHD as a feature at all. Since access to this data is a relatively new technology, leaders would have been unlikely to think about using it. Designing the main features of the app allowed us to gain insight into how people might interpret the data and utilize it for communities.

We followed a research through design methodology (Zimmerman and Forlizzi, 2014) in our approach to studying MoveMeant. Research through de-

sign argues for design researcher making the *right* thing, one that is intended to transform the world from a current to a preferred state (Zimmerman et al., 2007). It is used for solving "wicked problems," a challenge that might not be able to be accurately modeled that may have conflicting perspectives from stakeholders. Strengthening communities and building local ties could be considered a "wicked problem" and appropriate for research through design. This type of design is evaluated based on the rigor of process, novel technology to address a situation, relevance of the work, and extensibility to future design problems (Zimmerman et al., 2007).

To enact a research through design methodology, it was useful to follow the product service ecology, which "takes a systems approach to describe and understand the dynamic relationships between people, products, social activities, and the context that surrounds a system" (Forlizzi, 2008). The goal of the research was to produce knowledge about using location history overlaps for communities by gaining an understanding of the social structures in which we introduced the technology. As such, we found it valuable to interview both community leaders and members of different communities.

Instead of being limited to consumers of a product, service design argues for utilizing the competence of users to participate in the production of the services they consume (Kuusisto and Päällysaho, 2008; Prahalad and Ramaswamy, 2000). Tiramisu, a system that allowed commuters to share information about their bus rides, is an example of a co-designed system (Zimmerman et al., 2011). The transit service provides planned schedule information while commuters reported their GPS data and traffic issues to create the whole system together. In providing users with aggregated location data from their communities, we in-

tended for MoveMeant to be an instance of co-creation where the users create their own value from the information available. We attempted to expand upon co-creation by including not just user-reflection of the data in the app, but also stakeholders and how the information might be used by them.

To this end, in this chapter, we interviewed 15 community leaders and conducted observations at community meetings across three field sites of different types of communities. Interviewing community leaders provided us with insight into the social structure in which we deployed MoveMeant and ways in which the data may or may not help communities. With this study, we aimed to understand:

RQ*: How might aggregated community location data align with or oppose challenges and initiatives from community leaders?*

Our interviews suggest that communities face issues of lack of awareness, cohesion, identity, and representation, and that these issues exist across community types. While MoveMeant directly engages with awareness and has the potential to address cohesion and identity, on its own it may not be able to aid with a lack of political representation.

5.1 Methods

We conducted interviews with community leaders cross multiple field sites. The field sites were selected based on our criteria of communities that varied in type, density, diversity and were not earning above the median income of NYC since lower-income communities have been reported to be marginalized by technology in the past (Dillahunt and Mankoff, 2014; Thebault-Spieker et al., 2015).

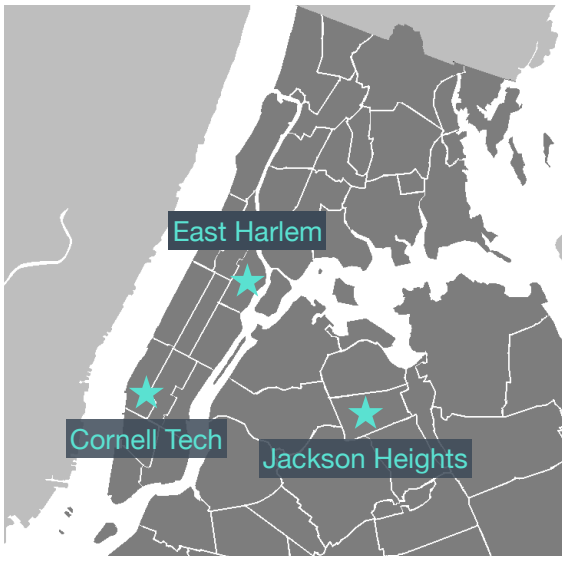

Figure 5.1: Map of New York City with field sites highlighted with stars

We used convenience sampling that allowed us access to those communities. We worked with three sites: one is an urban graduate school campus, Cornell Tech, and two were neighborhoods in New York City, East Harlem and Jackson Heights (see Figure 5.1). To develop context for the interviews and for recruitment, I spent over 20 hours in the field conducting observations at community-related meetings such as monthly community council meetings, the weekly greenmarket, and local town halls. Community leaders were recruited through reaching out to presenters at community meetings, emailing people with roles related to leadership, and snowball sampling.

We conducted 15 interviews with community leaders across the three field sites (6 from Cornell Tech, 6 from East Harlem, 3 from Jackson Heights). Leaders were not compensated for the interviews. The interviews focused on attributes of the community, initiatives that they and their organizations are working on, challenges they face as a community, and how their goals might be addressed

by the features offered by MoveMeant or similar applications. In a few of the face-to-face interviews where time permitted, we opened the app and showed it to the community leader for feedback. For the full protocol, see Appendix C.

The interviews were coded by two independent coders using a grounded coding approach with the aid of Atlas.ti[1]. Once phrases and sentences had been coded, the coders met face-to-face to discuss their codes and merge similar ones. The codes were then grouped according to the larger themes presented below.

5.2 Participants

Cornell Tech is a mix of graduate students, faculty, and staff on a small campus, located in the Chelsea neighborhood of Manhattan. At the time of the study, no housing was available to people working on the campus, which resulted in people commuting to the office from a mix of neighboring areas. We interviewed six community leaders (4 female) whose roles included government representatives and student service leads

East Harlem is a neighborhood in the north of Manhattan with a median income of $28,500. According to U.S. Census data, East Harlem is 47.6% Hispanic, 33.6% Black, 10.7% White, and 5.9% Asian[2]. We interviewed six community leaders (4 female) whose roles in the community included council members and block association organizers.

Jackson Heights is a neighborhood in the borough of Queens with a median income of $52,600. Jackson Heights is 57% Hispanic, 19.8% Asian, 14.3%

[1]http://atlasti.com/
[2]https://www.census.gov/

White, and 6.5% Black. We interviewed three community leaders (1 female) who worked as representatives for local organizations.

For a full breakdown of demographic information of participants, see Table 5.1.

ID	Gender	Time in Role	Organization
CTL1	Female	4 years	Student Services
CTL2	Female	2 years	Director of HR
CTL3	Female	>2 years	Student Services
CTL4	Male	1 year	Student Government
CTL5	Male	1 year	Student Government
CTL6	Female	2 years	Student Government
EHL1	Female	4 years	New Harlem East Merchants Association
EHL2	Female	2 years	GrowNYC
EHL3	Male	2 years	Harlem Neighborhood Block Association
EHL4	Female	6 years	Community Council
EHL5	Male	8 years	Harlem Community Development Council
EHL6	Female	4 years	Mt. Sinai Peer Engagement
JHL1	Female	4 years	Queens Neighborhood United
JHL2	Male	>13 years	Local Council Government
JHL3	Male	>11 years	Community Board 3

Table 5.1: Community Leader Participants

5.3 Findings

The findings are divided into categories of challenges that were discussed by community leaders. Even though the leaders were aware that we were deploying MoveMeant in their communities, we prompted them to discuss challenges that their communities face outside of the app. This information helped inform the researchers on the greater social structures and histories of the communities that might influence how their members might use the app. We present the findings by describing the issue and recounting interviews with community leaders that engaged with the issue. We organize the challenges raised by

community leaders into four main categories: awareness, cohesion, community identity, and political representation.

Participants are designated by their field site (Cornell Tech = CT, East Harlem = EH, Jackson Heights = JH) e.g. EHL5 is the fifth leader interviewed from East Harlem.

5.3.1 Awareness

One of the challenges for communities that was mentioned across the field sites was lack of awareness. The two types of awareness discussed by leaders of the community were awareness of resources available in the community and awareness of patterns of movement within the community. Community leaders across the field sites mentioned how an increase in awareness would help their communities, from informing members of what resources are available to knowing members' behavior to guide leadership's actions.

Awareness of Resources Increasing knowledge of what resources are available was a crucial part of several community leaders' work. One leader, who works at the local hospital in addiction recovery, bases much of her work on collecting information to share with people in the community. *"[I've] gone around to all the different churches, community based organizations and everything, written out everything that they need that they have, and put it together in a resource book"* (EHL6). Resources were brought up by another East Harlem leader, saying

> *"The reason why we do a health fair and organization youth fair is because one of the other things with our community is that we have a high level*

of narcotics shelters in the neighborhood. Those people need to find the resources to be healthy. All the people that are going to come to our fair, we try to make sure we have resources" (EHL4).

One organizer commented on the potential usefulness for newcomers: *"We have the balance of people who know New York really well and we also wind up bringing a lot of people who don't know New York at all...could be really interesting for people to just feel like, what are the patterns, and where are people going and what's of interest, and maybe even identify activities, landmarks, parks, things nearby that they weren't even aware of"* (CTL2).

Awareness of Patterns Awareness could also help community leaders be more effective in their work.*"If there's one piece of information that somebody's always looking for, and not just one person but like lots of people are looking for, that would be helpful to know so that we can make sure that it's front and center somewhere"* (CTL1). EHL2 described potential usefulness of MoveMeant for her work on addressing the 'food desert' in East Harlem: *"By tracking [the residents], we get a picture of their daily routine. How much time they're putting into grocery shopping and traveling to some other store and also the frequency. That would be very helpful to understand people's shopping patterns."* (EHL2).

Awareness could potentially lead to more social interaction*"There might be people that think they're wonderful community members, and you're only really talking to two or three other people... Is that your definition of community? Is that our definition of cultural community? ...But wouldn't it be awful to nice to say, "Oh, I can join this group to go do that even though I'm not on that 'team."'* (CTL3)

For other organizers, the awareness triggered ideas around different kinds

of data sources. For example, a grassroots organizer in Jackson Heights described how awareness of the police biases in the neighborhood was important to creating a safe community for residents. She said,

> *"There's a problem and we need to present not just the community but everyone with the facts and that these are the numbers. This is the number of stop and frisk...It is not because people are more prone to crime or more prone to committing these, it's just that we live in a community that is being targeted by a policing tactic called 'broken windows' policing"* (JHL1).

5.3.2 Cohesion

Lack of cohesion was brought up as a challenge by community leaders across the field sites. Divisions between job roles, race, and geography contributed to feelings of separation between factions of the same community.

One common issue across the different field sites was the separation between different factions within the same community. While the nature of the split differed depending on the community, lack of cohesion was frequently brought up during interviews with community leaders.

At Cornell Tech, the community is divided by position or role at school, degree program for students, and also by cultural differences. "*"Based on our size it would be nice to have more of a sense of community across the different populations. Master's students, PhD students, staff, faculty. . . I feel like there's this sense of community within pockets of the population"* (CTL2)." CTL1 explained that one of their general goals was to bridge between students who are in different degree pro-

grams. *"We do want to make sure that people are integrating. We don't want like cliques of students necessarily, and that is hard to manage"* (CTL1). Given the large international population of incoming students, CTL6 also mentioned divisions across cultures.

In Jackson Heights, the neighborhood is divided by different immigrant populations that moved to the area at different points in history, including more recent wave of upper-middle class non-minority population. JHL2 explained the breakdown of different factions within the neighborhood.

> *"There's that pocket…heavily Dominican. People in Jackson Heights don't really think of that portion as being part of Jackson Heights…That's really what I think about when I think of Jackson Heights, and…the immigrant population is mainly Colombian, some Portuguese as well. …South Asians that live on, let's say 69th street would be different from those who live on 75th street in terms of class, wealth disparity, so once again it's also that small pocket of other Jackson Heights"* (JHL2).

Given the geographic nature of location data, we were interested to see if the data in MoveMeant would reflect these distinctions or not. The neighborhoods divisions exist beyond racial lines as well as JH1 explains,

> *"I feel like it's definitely an immigrant community that is diverse both racially and economically but that is not being served adequately I have to say. I think that people have their enclaves and they get close to each other in that way in their communities but that's it. [They are divided] by ethnic group, by economic class, by the kind of job that you do" (JHL1).*

In East Harlem, the primary distinction is between the African-American and Latin-American parts of the neighborhood. As EHL5 described,

> *"This neighborhood is not very close knit...People in the 0029 [zip code] are generally Latino, which is El Barrio. 0035 generally is African American, and they don't kinda get along on the same trip. Right now, this side of the equation wants to kind of break away from El Barrio... El Barrio wants to keep El Barrio. In other words, you're not gonna have La Marqueta called The Market" (EHL5).*

5.3.3 Community Identity

Interviews with community leaders revealed their desires to establish and maintain a positive culture, while users interpreted the data from MoveMeant as affirmation of their observations of the community's existing or changing identity. Community identity was important for leaders to establish for newly formed communities, to improve for communities with negative images, and to maintain for areas that were undergoing gentrification.

Cornell Tech is a relatively new community, so leaders mentioned a desire to *"establish better student traditions"* (CTL4) and *"build a cross community culture"* (CTL5).

Shifting Identity In East Harlem, some changes in the community have been welcomed by long-time residents. As EHL1 described of one particular intersection,

> *"That first summer, people would come out there, and I would see old*

> *women…come up to me just crying…'I never thought that people would think to make this a good place for my family,' and 'I've been seeing drug deals going down here since I was ten years old.' It's amazing, that kind of thing…So I think that's been the most beneficial thing, just watching people connect in this space, and start to take ownership of their community"* (EHL1).

However, not all changes to community identity are positive.

In Jackson Heights, the issue of gentrification is a concern that could be displacing residents. As JHL1 explains, *"Policing and gentrification work hand in hand. They're both tools in order to displace and actually expel people from communities for desirable land"* (JHL1). JHL2 describes how the landscape of stores reflects the undercurrent of change when he said, *"82nd street has shown that corporations are willing to come in and they can take over the neighborhood and take over the small mom-and-pop stores"* (JHL2). The new stores are catering not to locals or *"servicing the working class people that are there"*, but *"to the tourists that are coming to Jackson Heights, the ones that want to go to little India and try out Indian food, or visit a Columbian spot. The momo [type of dumpling] crawl"* (JHL2). While gentrification was an issue found in Jackson Heights, it is a topic that is of growing concern in other cities as well (Lees et al., 2016).

5.3.4 Political Representation

One of the key issues that was brought up during interviews with community leaders across the different field sites was lack of political representation. Leaders discussed problems including placement of undesirable city services, un-

representative groups in government, and bribery of other community organizations to push forward politicians' agendas.

At Cornell Tech, student government representatives spoke about concerns with their political relationship with higher-up organizations as well as ensuring that they were able to provide for the needs of their diverse community. CTL4 explained that as a satellite campus, the interaction with Ithaca was a delicate political situation.

> *"They were unhappy with us kind of not communicating with them so finding a process to make sure that we do communicate with them on the one hand, on the other hand that we're not harming anything that has to do with the finance involved, dealing with that. There are sensitivities around that being kind of open and aware of that and treading lightly where light treading is required"* (CTL4).

CTL6 described the difficulty of deciding what is fair representation in student government, given the different groups that the government is intended to support. She explained,

> *"Would something like an international student Liaison be more helpful than having two computer science students? And that's a very specific example because all the Liaisons...had been educated in the US or from the US or Canada. So it was definitely something that was like, 'International students are actually in the majority at the Masters programs and it's actually pretty bad that we don't have them.' And yes, we were going by programs, but it's not the best to go around representing what exists in our community"* (CTL6).

JHL2 described the complex relationship with the elected officials in Jackson Heights who were trying to establish part of the neighborhood as a Business Improvement District (BID). BIDs receive public funding from the government of New York to spend on services for the district e.g. street cleaning, beautification[3]. While BIDs may seem desirable to a local community, JHL2 explained that her organization researched other BIDs to find that *"This is just a kind of urban planning strategy or method that people think will work but actually it just works in the interest of property owners"* (JHL2). Her grassroots organization fought against the Jackson Heights BID in an effort to protect the predominantly immigrant storefronts that would potentially be negatively affected by the BID. She described the corruption occurring between the politicians and local organizations, saying

> *"Politicians give money to non-profits, 51C3 activist group associations letting officials line their pockets for their causes, and everything's good. Those groups will, in turn, fight for what elected officials want. The electives who wanted the BID, they paid off groups to support the BID" (JHL2).*

In East Harlem, many of the challenges faced by the community related to safety and sanitation stem from a lack of political representation. At the time, a pertinent issue was a controversial bill to introduce another garbage disposal site into the community. EHL5 described all the homeless shelters, methadone clinics, and garbage disposals that are already in East Harlem.

> *"Because you got 800 homeless men dropped off at Lexington Avenue everyday, you have the highest concentration of methadone maintenance clinics*

[3]http://www1.nyc.gov/site/sbs/neighborhoods/bids.page

in the city, you attract the puss of the world on this side… You've got a garbage dump on 131st street, now you're gonna put another one around the bend, and you wonder why you have an asthma problem" (EHL5).

The implication for East Harlem residents is that

"A lot of people say they feel less safe. It's not as clean… And there's just a lot of social issues on this side of town… The people that are in the homeless shelters are not from the neighborhood. They're from other places. And there's also a whole bunch of homeless shelters that are actually on Randalls Island, Randalls and Wards Island, and so their people are not given services during the day, so they're forced to leave the shelters, and the bus brings them from the island" (EHL1).

Part of the reason that East Harlem lacks representation is the way that the district lines are drawn by the government. EHL1 explains,

"This particular little zone in northeast Harlem, it's half in city council district 8 and half in city council district 9, and that's also part of the reason for the fragmentation. We don't have one city council person to really advocate for us… If we had had adequate representation politically, those representatives could've put a stop to a lot of the preventing that has happened to bring these things [sanitation garages and drug treatment facilities] here. But a lot of the political representation just hasn't stood up for the community." (EHL1).

Related to the drawing of district lines is that as a lower-income neighborhood, East Harlem has less political sway. EHL3 said,

"Because the wealthier neighborhoods are more politically connected, they have money available to foist lawsuits. They also tend to be more highly developed in terms of the land physically. There's a lot of space, as you've seen, in East Harlem. There are vacant lots. There are abandoned buildings... So we suffer because of underdevelopment makes us very susceptible to development, plus all of the political, economic, and racial, cultural issues that cause that" (EHL3).

5.4 Discussion

A subset of the challenges described by community leaders were related to MoveMeant or addressable by similar technology. While MoveMeant directly engages with issues of lack of awareness, and potentially lack of cohesion and community identity, lack of political representation is less easily solved with technology.

MoveMeant has the potential to aid in issues of awareness of resources for members of the communities and awareness of patterns. An app that uses passive location tracking has the potential to bring to the forefront resources that may be useful to people in the community, especially those that are new to the community. Similarly, MoveMeant could provide insight into patterns of behavior in the community. This type of aggregated data could potentially reveal police biasing reported by JHL1 to make residents better informed of their neighborhood. The same data could also be useful for community leaders to gain insight into how people are using the resources in the community and guide leader efforts based on this data. CTL1 also raised the possibility that

aggregated tracking of information other than locations might be useful. Websites or articles could use the same type of anonymous tracking as MoveMeant to provide useful data of another kind.

Cohesion was an issue that we hoped MoveMeant might alleviate. The racial, economic, and geographic divisions within a community that were described by leaders likely exacerbate the difficulty of creating connections in urban areas that we described in Chapter 1. With MoveMeant, users were expected to be exposed to location data that could reveal the popular places across different sub-groups within a community. Because the data from different sub-groups would be undifferentiated, the knowledge of the popular places might increase fluidity across venues that are frequented by different people. Mixing of groups could potentially lessen the barriers and distinctions between groups through limited exposure.

We expected that community identity would be reflected in the MoveMeant app data. Based on the goal of Cornell Tech leaders to establish a community, we anticipated that locations for that field site would be mixed and not-well clustered. We were unlikely to be able to observe the shift in identity that East Harlem leaders described unless we conducted a longitudinal study of the app over several years, but MoveMeant usage might still reflect the changes in the community by including a mix of different kinds of locations. Finally, it was unclear how gentrification might manifest itself in the MoveMeant data. Locals downloading the app may not visit the 'touristy' places contributing to gentrification in which case they would not appear in MoveMeant, or perhaps app users would patron such places in which case they would contribute to the data. How MoveMeant was actually used by members of the communities and

whether it aligned with our expectations is the focus of Chapter 4.

The lack of political representation was unlikely to be directly affected by the MoveMeant app, but suggests the complexity of community definition. One of the findings from our study is that defining community based on zip code or name are insufficient at capturing accurate groupings of people. Like previous studies on geographically-based communities (Lu et al., 2013; Riederer et al., 2015), we define communities in the app based on neighborhoods distinguished by government boundaries. However, as was highlighted in interviews with community leaders, *"political boundaries are arbitrary lines"* (EHL3), echoing previous research on the difficulty of defining localness (Sen et al., 2015) and the complicated nature of social structure (Whyte, 2012). Separating people based on zip code, or any unique and well-defined mapping from location to community, may be distinct but overly simplistic and not capture the nuanced groupings within a community. Instead, a fluid definition of community may be more applicable. Assemblage theory provides a useful framework for the purpose of defining community (DeLanda, 2006). Instead of a top-down approach to defining a community, assemblage theory argues for a bottom-up approach by observing how component parts interact with each other through *relations of interiority*; the very relationship between components defines the components themselves. From this perspective, community apps would not require users to fit into a defined community. Rather, different clusters would naturally surface based on the data overlaps, allowing users to exist in multiple communities at the same time, and have the community reflect the natural evolution that occurs in the communities. While these definitions of community are much more technologically difficult and complex to execute, they would more accurately reflect the fluid nature of how communities function, though fluid communities

are beyond the scope of the current work.

5.4.1 Limitations

While we attempted to conduct our study across multiple field sites, we realize that there are limitations to our study. Even though the communities were distinct from one another, they were all restricted to New York City, which could have biased our findings. We studied neighborhoods and a campus, but we imagine that our findings would extend to other communities as well, such as religious or cultural groups, though we did not study the effect on more formal organizations.

5.5 Conclusion

In this chapter, we interviewed 15 community leaders in order to gain a deeper understanding of the communities in which we deployed MoveMeant. Leader interviews provided insight into the challenges that these communities face. While we focused on three different types of communities within New York City, we imagine that the challenges of lack of awareness, cohesion, community identity, and political representation would apply more generally to other communities as well. In Chapter 6, we deploy MoveMeant with members of these communities and examine how the challenges and expectations described here manifested in users' experiences with the app.

CHAPTER 6

A LARGE-SCALE FIELD DEPLOYMENT OF MOVEMEANT

In Chapter 5, we interviewed leaders across three different field sites to learn about the challenges faced by local communities. Our findings showed that the main issues stemmed from a lack of awareness, cohesion, identity, and political representation. While we discussed ways in which MoveMeant *could* help with overcoming some of these challenges, a question remained as to whether or not actual MoveMeant usage would reflect these expectations.

To address this question, we conducted field deployments of MoveMeant to understand the meaning derived from location overlaps and assess whether MoveMeant was able to address the challenges discussed by leaders in Chapter 5. Work in community informatics was useful to understand different ways in which technology can engage communities. A number of research projects and consumer products have been designed to aid community development. These include engaging citizens with their local government, empowering communities through voting devices, and creating forums for civic engagement (Bugs, 2014; López and Farzan, 2015; Taylor et al., 2012). The present study is situated in other work on the bottom-up use of technology for civic involvement (Bugs, 2014) and identifying the potential benefit to local community of this research (Le Dantec and Fox, 2015). Our app integrated location information with community informatics as a suprathresholding app. Suprathresholding apps are one of two types of location-dependent apps for community networks identified by Carroll (Carroll et al., 2015b). They aggregate local content, which helps ease issues of critical mass.

A subset of HCI research has explored the relationship between geographic

location and community development. In their work on local community informatics, Carroll & Rosson highlight the importance of place as "the most basic shared community infrastructure." (Carroll and Rosson, 2013). App Movement[1] was a platform that allowed communities to generate their own location-based review applications. Their deployment showed that locations are valuable for communities (Garbett et al., 2016). Another app, Journeys, used overlapping endpoints to allow users to leave notes to one another traveling on the same path. Their findings showed that the app was able to facilitate knowledge sharing and human contact asynchronously and pseudonymously (Cranshaw et al., 2016). Taken together, the previous research on community apps suggest that location information has the potential to be valuable to share at a community-scale, which we explored with the MoveMeant app in this work.

The present study builds on and significantly expands the preliminary deployment described in Chapter 4 by conducting wide field deployments with 118 users across multiple sites and examining different types of communities. We combine this data with the information gathered from our interviews with community leaders in Chapter 5 to answer,

RQ1: *How is aggregated community location data interpreted by individuals in different communities, and what meaning is extracted from it by these individuals?*

RQ2: *How does aggregated community location data align with or oppose challenges and initiatives from community leaders?*

While the findings from our interviews with MoveMeant users suggest potential for location data to align with community leaders' awareness goals, we extrapolate to propose an intermediate step of surfacing that may contribute to

[1]The app name is similar but not related to ours

the amplification effect of technology (Toyama, 2011). Our work suggests that the location data could potentially be used for aiding community leaders in their work with political representatives. We provide implications on the design of community apps based on our results.

6.1 Methods

We worked with same three field sites as in Chapter 5: one is an urban graduate school campus, Cornell Tech, and two were neighborhoods in New York City, East Harlem and Jackson Heights. Participant recruitment on the campus was conducted through presenting at a campus-wide meeting, as extra credit for a master-level class, and snowball sampling. For recruitment in the neighborhoods, we partnered with local organizations (community council, merchant's association, and a local café) to recruit at their events. A total of 118 MoveMeant users were recruited across the three field sites (53 from Cornell Tech, 35 from East Harlem, and 30 from Jackson Heights). The app was then used in each community for about seven weeks before participants were recruited for follow-up interviews. During the seven weeks, participants received a weekly summary email of the popular places for that week to encourage continued engagement with the app (see Figure 6.1). Participants were compensated $10 for downloading the app and an additional $10 for participating in the interview.

We conducted 30 interviews with members of the communities across the three field sites (16 from Cornell Tech, 7 from East Harlem, 7 from Jackson Heights). Interviews covered their experience asa member of the community and their frequency and usage of the app. Interviews also included a session where participants opened the app and a summary email, discussed the con-

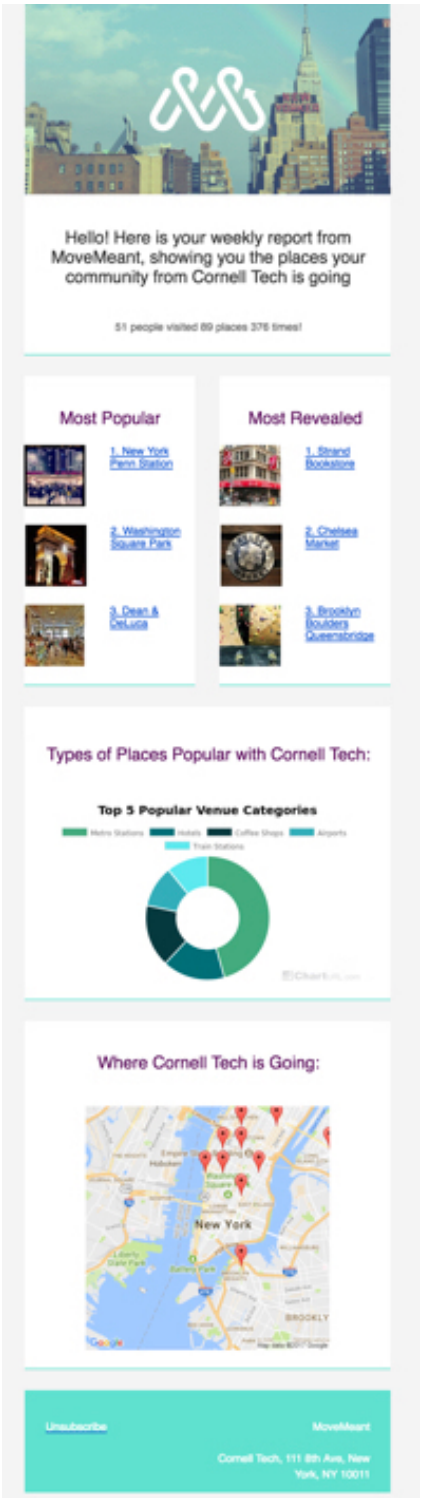

Figure 6.1: Example of a weekly summary email sent out to participants

tent they saw, and pointed out any particular venues that were surprising to them. Interview audio was recorded and transcribed. For the full protocol, see Appendix D.

The interviews were coded by two independent coders using a grounded coding approach with the aid of Atlas.ti[2]. Once phrases and sentences had been coded, the coders met face-to-face to discuss their codes and merge similar ones. The codes were then grouped according to the larger themes presented below.

6.2 Participants

As described in Chapter 5, Cornell Tech is a mix of graduate students, faculty, and staff on a small campus. At the time of the study, no housing was available to people working on the campus, which resulted in people commuting to the office from a mix of neighboring areas. We interviewed 16 users from Cornell Tech (11 female, median age of 24 years).

East Harlem is a neighborhood in the north of Manhattan with a median income of $28,500. According to U.S. Census data, East Harlem is 47.6% Hispanic, 33.6% Black, 10.7% White, and 5.9% Asian[3]. We interviewed seven users (3 female, median age of 29 years) whose jobs included nonprofit worker, entrepreneur, and engineer.

Jackson Heights is a neighborhood in the borough of Queens with a median income of $52,600. Jackson Heights is 57% Hispanic, 19.8% Asian, 14.3% White, and 6.5% Black. We interviewed seven users from Jackson Heights (5 female,

[2]http://atlasti.com/
[3]https://www.census.gov/

median age of 34 years) whose jobs included nurse, social worker, and pet care worker.

A detailed breakdown of the participants can be found in Tables 6.1 and 6.2. Occupation was not included for the Cornell Tech participants since all of them were students except for one staff member.

ID	Gender	Age	Time in NYC
CT1	Female	22	–
CT2	Female	22	–
CT3	Male	25	–
CT4	Male	25	2.5 years
CT5	Female	22	9 months
CT6	Male	24	9 months
CT7	Female	24	3 years
CT8	Female	23	9 months
CT9	Female	25	9 months
CT10	Female	19	9 months
CT11	Male	29	8 months
CT12	Female	21	9 months
CT13	Female	23	9 months
CT14	Male	33	33 years
CT15	Female	25	2 years
CT16	Female	–	9 months

Table 6.1: Demographic Information of Cornell Tech Participants

6.3 Findings

The findings are divided into categories of challenges that were discussed by community leaders in Chapter 5, with the exception of political representation, which was not a topic that arose during our interviews with MoveMeant users. We present the findings by describing the issue and summarizing interviews and data from MoveMeant users that reflected on the issue. We organize the challenges raised by community leaders and addressed by participants us-

ID	Gender	Age	Time in Community	Occupation
EH1	Male	34	18 months	Chemist
EH2	Female	28	2 years	Nonprofit
EH3	Female	39	16 years	Sales Engineer
EH4	Male	19	6 months	Green Market Employee
EH5	Male	29	2.5 years	Developer
EH6	Male	24	4 years	Coordinator
EH7	Female	31	6 years	Chocolate Entrepreneur
JH1	Female	41	8 years	Nurse
JH2	Female	28	1 year	ESL Teacher
JH3	Male	34	5 years	Architect
JH4	Female	28	3 years	Social Worker
JH5	Female	61	25 years	Pet Care
JH6	Male	48	7 years	Sound Design
JH7	Female	21	21 years	Student

Table 6.2: Demographic Information of Participants from East Harlem (EH) and Jackson Heights (JH)

ing MoveMeant into three main buckets: awareness, cohesion, and community identity.

Participants are designated by their field site (Cornell Tech = CT, East Harlem = EH, Jackson Heights = JH). The age and gender of participants is given for the users of MoveMeant, e.g. EH4-28F is a 28-year-old female and the fourth interviewed user of MoveMeant from East Harlem.

6.3.1 Awareness

Interviews with MoveMeant users indicated that the app helped them gain an awareness of local knowledge that otherwise predominantly traveled through word of mouth as well as an awareness of the general patterns of movement of the people around them. The resources discussed by users differed from the kind mentioned by leaders in Chapter 5, but this difference could be attributed

to the population of users that was recruited for the study.

Awareness of Resources Twenty-one participants (70%) mentioned that the app helped them increase their awareness of knowledge that is specific to locals or finding value in the app being used by community members. By limiting the app data to locals, the result was information accumulated by those who are familiar with the area. One participant explained the value of local information, saying,

> *"I wouldn't care for the opinion of someone who just came through and decided oh, I love this part, maybe you should visit it when you go, because you wouldn't necessarily have any sort of context for what life was actually like in a neighborhood. So I would definitely take neighbors' or residents' word or advice over just anyone"* (JH2-28F).

Another participant made an analogy to using the app as a local's guide. He said,

> *"It's like going to Disney World versus going to some other little town in Florida. We all know Disney World, we all know Indian food in Jackson Heights, but you don't know the real area. How do you get that, in my opinion? Through a local perspective which is something like your app"* (JH6-48M).

Similarly, in East Harlem, a participant described how the app would identify local hotspots. ""*It means something that you've regularly got a hotspot of only locals going to this one place, or these five places. That means a lot to me, I guess. Like, how*

many people from East Harlem go to Red Rooster [an expensive local restaurant]?" (EH5-29M)."

The app made overt information that may have commonly traveled invisibly. A Jackson Heights participant explained how important word of mouth is to dissemination of information.

> *"We know a woman on this and such street who makes the best bread, so everybody goes to her. Or if you want good…arepas, go to this over Venezuelan spot…geared towards word of mouth because there's such a heavy immigrant population and there they've sort of set up internal, informal system of the way things work"* (JH2-28F).

CT14-33M echoed this sentiment when he described MoveMeant as an app form of word of mouth, and added: ""*You're learning where there's a lot of foot traffic, which sometimes for a place that's really good, but maybe not necessarily hugely popular, as far as notoriety, might be a good place to go"* (CT14-33M)." Another participant explained how the data in the app reflected the information that was already traveling invisibly. ""*I feel like a lot of people in that place, my community already knows where the hot spots are. When my parents ask about where are good places to eat, by word of mouth, so I've seen that reflected on the actual app data"* (JH7-21F)."

Awareness of Patterns Across the field sites, nine participants (30%) mentioned that MoveMeant increased their general awareness of their communities. One participant described it as *"weirdly voyeuristic, where it's kind of cool to know what people are up to or what the patterns are in the neighborhood."* (JH4-28F). Another participant described the app as supporting evidence of her existing beliefs about the community when she said, *"It was like more validation of what I*

already knew. It's interesting to visualize it, something that you only know, like kind of theoretic" (EH3-39F). A Cornell Tech participant described a time when the location awareness resulted in her realization that people were traveling during spring break. *""I live in Jersey and then usually there's a dot on the Newport Center or something. Suddenly, I noticed for that week... no dots showing up there. So I assume everyone just living in Jersey City is out of town"* (CT7-24F)." For another participant, the increased awareness changed his opinions about who was going to a particular venue in the community. *"Blink Fitness is an interesting one to me. Does it surprise me? No, but I never thought locals would go there. They do. I was wrong on that one"* (JH6-48M).

6.3.2 Cohesion

The location overlaps captured by MoveMeant reflected some of these divisions mentioned by community leaders in Chapter 5, as did user interviews reporting feelings of isolation from the community. MoveMeant users indicated an interest in places based on similarity, which could contribute to the lack of cohesion reported by leaders.

The location overlaps captured by MoveMeant reflected the geographic divides of the neighborhoods. At Cornell Tech, people were commuting to campus from different areas around New York City, leading to locations that were spread out all over the city (see Figure 6.2). The divisions between roles on campus or program were not reflected geographically. In contrast, Jackson Heights and East Harlem showed distinct divisions. In Jackson Heights, the overlapping venues fell within 73rd St and 82nd Ave from Roosevelt Ave up to North-

ern Blvd (see Figure 6.3). Significantly, no venues were included in what was described by JHL2 as the heavily Dominican area or the South Asian area. In East Harlem, the primary area of location overlaps was between Lexington Ave and Malcolm X Boulevard (see Figure 6.4). This area is closer to Central Harlem, not in the center of what is geographically considered East Harlem, indicating a lack of overlaps within the heart of the neighborhood. A breakdown of the top ten most visited venues for each community can be seen in Tables 6.3, 6.4, and 6.5.

Venue	**Count**
Cornell Tech	44
Chelsea Market	16
Metro Stop (14th St)	15
NY Penn Station	15
Newark Airport	13
Union Square Park	13
Starbucks	12
Metro Stop (42nd St)	12
Starbucks	12
Grand Central	11

Table 6.3: Cornell Tech Top Ten Most Visited Venues

Venue	**Count**
Espresso 77	24
Metro Stop (74th St)	9
Jackson Heights Greenmarket	8
Starbucks	6
Metro Stop (65th St)	5
IS 230	5
The Greystones	5
Elmhurst Hospital Center	5
Travers Park	5
Central Park	4

Table 6.4: Jackson Heights Top Ten Most Visited Venues

Similarity Sixteen participants (53%) mentioned interest in the places shown in the app because they reflected the opinions of people who were similar to them. JH6 described a farmer's market that appeared in the app.

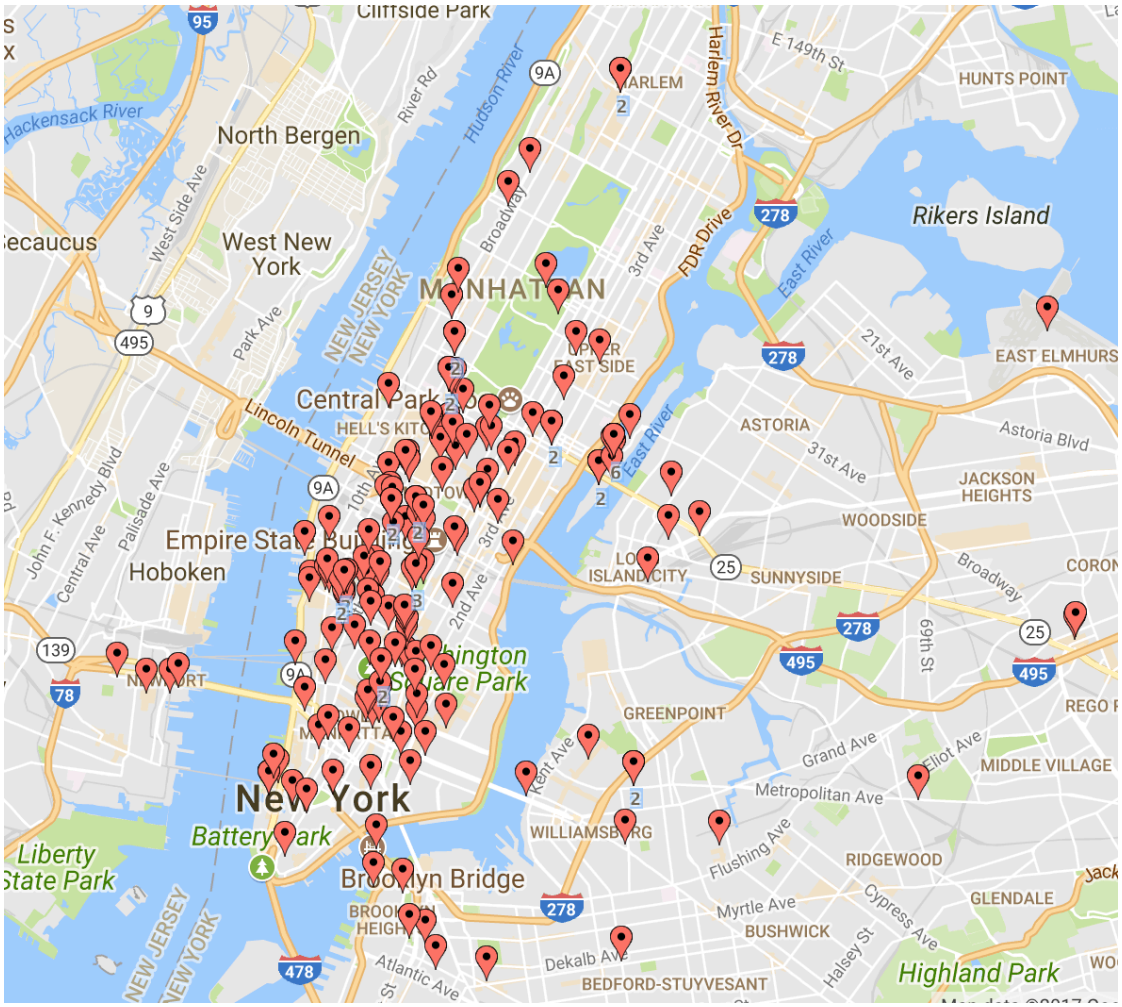

Figure 6.2: Map of venue overlaps for Cornell Tech

> *"Eight people have been to the Jackson Heights Green Market, to me, makes perfect sense. I go [there] because people here tend to be a little more organic, want fresh vegetables…I know a lot of locals don't go there because the prices are a little higher than going to the local fruit stand"* (JH6-48M).

An East Harlem resident described the desire to find people based on locational similarity.

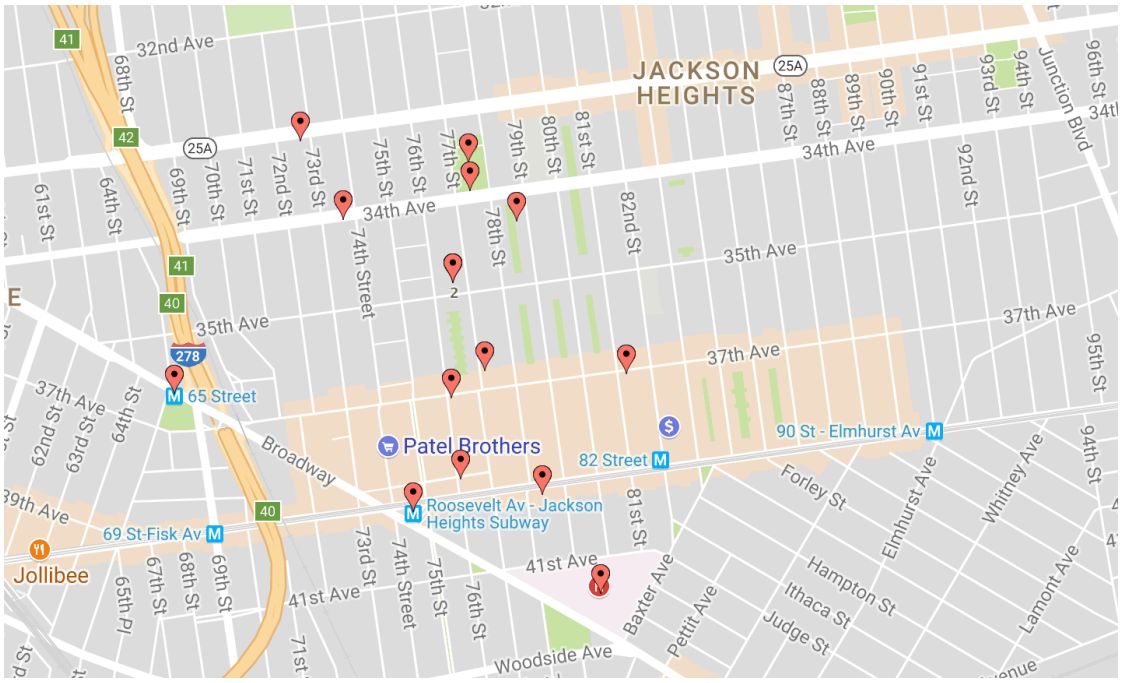

Figure 6.3: Map of venue overlaps for Jackson Heights

Venue	**Count**
Harlem 125th St Station	20
Grand Central Station	5
Sylvia's Restaurant	5
Marcus Garvey Park	4
Metro Stop (14th St)	4
Metro Stop (110th St)	4
Metro Stop (42nd St)	4
Newark Airport	4
Metro Stop (96th St)	4
National Black Theater	4

Table 6.5: East Harlem Top Ten Most Visited Venues

"In a city that's as antisocial and averse to talking to strangers as New York City, it would be nice to have an interesting set of data to see are there people who I would frequently see more often and be able to get to know because we seem to have overlapping hot spots..." (EH5-29M)

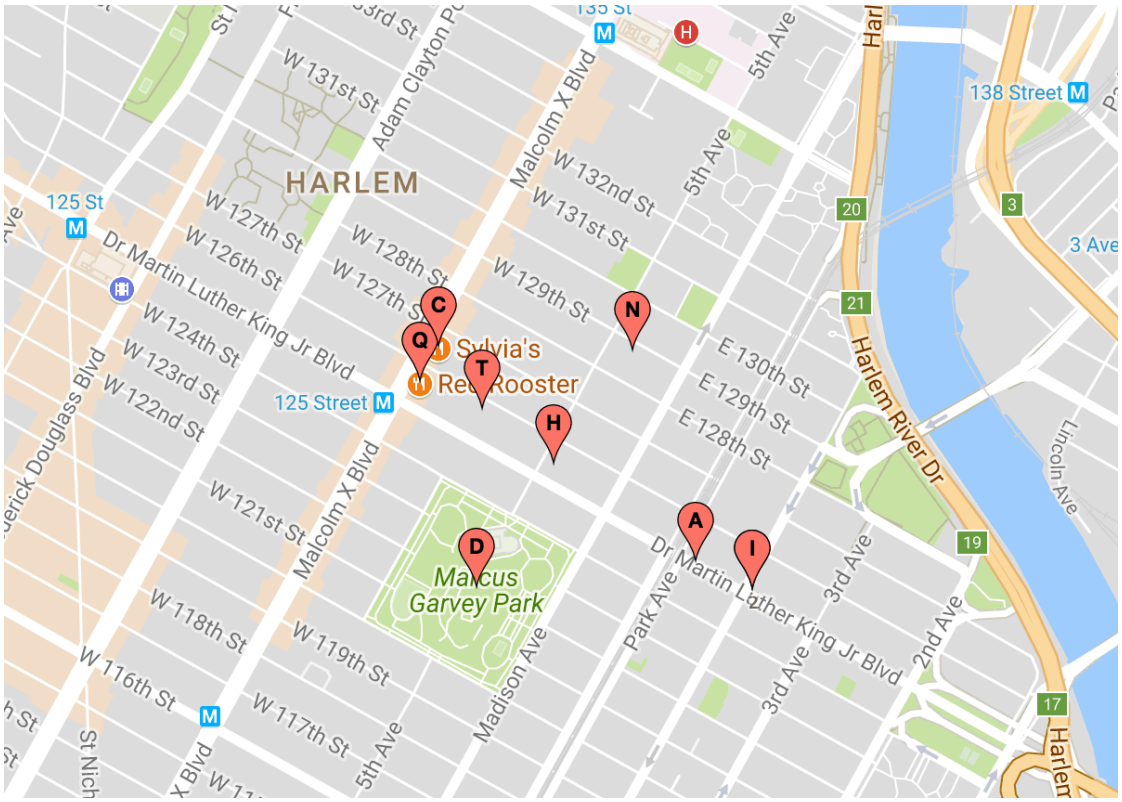

Figure 6.4: Map of venue overlaps for East Harlem

Some participants also assumed that locations shown in the app were reflective of practices that they themselves go through. As one East Harlem participant said, *"125th Station I knew, and I figured that must've been the people picking up vegetables like me"* (EH3-39F). CT12 described how she expected others to go through the same kind of research on restaurants she went through and therefore trusted the locations in the app.

> *"Because it's like the similar background, right? . . . a lot of them are going to go through the same process I would, and that's going through like researching different places. . . 'Cause that's what I do a lot. . . Just from that, I have that assumption that they're going through the same process, so their*

opinion is probably going to be better." (CT12-21F)

Similarity that became apparent through the use of the app could contribute to the community issue of lack of cohesion. People indicated that they were more likely to go to places that they perceived other people *like themselves* were going to. This tendency would seem to lead to further divides in the community as those in the Latin-American area of East Harlem, for example, would want to find out about other places that Latin-Americans frequent instead of those frequented by the African-Americans in their neighborhood. While the app has the potential to surface popular places amongst different groups within the same neighborhood, it's unclear whether people would choose to go to those places that were outside of their in-group.

Isolation from the Community A few people across the different field sites indicated that the location data also had the potential implication to make them feel isolated from their community. Five people (17%) mentioned that their personal location histories did not match that of their communities. People whose personal data or places were not reflected in the app could lead to feelings of separation from the community.

In Jackson Heights, one participant noted this trend since he was unfamiliar with many of the places surfaced by the app. *"Most of the places I go to they're apparently not that popular...As Europeans, we're like minorities, so maybe our taste in food and things might be different than the majority of the population, you know?"* (JH3-34M). A Cornell Tech user had the same experience, noting the feeling of sadness that can accompany identifying as part of the out-group. *"It's kind of surprising because I've never been to any of them...I know maybe I'm at the edge of the Cornell Tech group...It makes me feel sad"* (CT6-24M). The separation was

also made more apparent for a Cornell Tech participant who lived farther away. She said, *"Since I'm an outlier, I keep checking on it like, 'Oh, nobody logged into your area"* (CT16-F). However, another Cornell Tech participant suggested that these differences might not always be a negative indicator, instead favoring the isolation. She said, *"I like unique things. I'm scared to have the same thing as people. If I have my thing, I want to keep it that way."* (CT10-19F).

The isolation that became more apparent from using the app could also exacerbate the lack of cohesion. By making blatant that people's behavior were different from the rest of their community, they could feel further separated from and decrease their identification with the community. We explore this finding more in the discussion.

6.3.3 Community Identity

Interviews and the types of locations captured by MoveMeant showed that the app surfaced certain attributes of the community as well as reflected shifts in the community identity.

Over the seven-week deployment, MoveMeant captured 23 venues in East Harlem visited by three or more people, 43% of which were subway stations. This compares with 40 venues in Jackson Heights, 27% of which were subway stations, and 198 venues at Cornell Tech, 27% of which were subway stations. It is difficult to draw any conclusions based on the number of venues since each group was a different size. However, the fact that Jackson Heights had almost double the number of overlapping venues to East Harlem with a fewer number of participants indicates that people using the app in Jackson Heights visit

more similar places. The higher percentage of subway station in East Harlem compared with Jackson Heights and Cornell Tech also suggest that the overlaps might not be as meaningful within the community.

Identity Affirmation A few participants mentioned how the location overlap provided them with a broader view of the neighborhood, whether affirming existing impressions or forming new ones. Jackson Heights had a number of restaurants appear on the list of location overlaps, which one participant interpreted as an indication of the nature of community.

> *"The fact that there's so many restaurants I think just kind of reinforces sort of the communal aspect of the neighborhood and there's a lot of, sort of, people like to get together. At any given time, when you walk out you see a group of people or family, a group of friends…I think those results just probably reinforced but I already sort of assume about the people in the neighborhood"* (JH2-28F).

An East Harlem resident saw a small restaurant in the list of locations and described how the app indicated the types of businesses the community supports. "*"In terms of restaurants and small businesses, where does the neighborhood spend their money? Do they support the small businesses? Do they go to these little hole-in-the-wall restaurants? Or don't they?"* (EH7-31F)."

Shifting Identity Eight of the participants (27%) brought up how MoveMeant reflects changes in the neighborhood. When listing places she'd seen in the app, JH7-21F mentioned,

> *"There was Emoji Burger, which is like where all the hipsters eat. Like my*

friends refer to it as that... I can understand how it's come to be one of the more popular spots. I guess it's kind of like, further reinforcing kind of the trendsetters that my friends and I have noticed" (JH7-21F).

The trend mentioned by JH7 is reflective of the concern around gentrification as discussed above. In East Harlem as well, gentrification arose as a concern for participants using MoveMeant. One participant explained how MoveMeant could capture the changes in the neighborhood.

"When Whole Foods opens. . . , are we going to actually see a lot of people at Whole Foods? And like, the So What to that is well there's been so much discussion around that Whole Foods and are residents of East Harlem actually going there? Yeah I just think it's sort of, as a barometer of the community and what people are actually responding to and understanding shifting demographics and preferences. . . I feel like that the app could potentially have a real pulse on that if you had enough people using it and you had a sense of how you wanted to interpret it" (EH2-28F).

As an app, MoveMeant only captured a subset of people in the community and inherently introduced bias. JH1 described a third place in the neighborhood, a bagel shop frequented by long-time residents of the neighborhood.

"Sometimes I know their names, and I know them by sight. They recognize my children. So yeah, there's just something that's kind of nice about that. Having generations that can enjoy a place, but those aren't the kind of people that are going to be on an app" (JH1-41F).

She did not expect these familiar strangers to have downloaded the app be-

cause they were an older demographic. Similarly, an East Harlem participant expressed concern about who was using the app based on the locations overlaps. She said,

> *"Grand Central and Red Rooster, I mean, I think I was kind of like, 'Oh, are there just a lot of commuters that ended up installing the app and now they're commuting to Grand Central'...Or maybe it is indicative also of how much the demographics are changing here.' It makes me wonder who's using the app"* (EH2-28F).

6.4 Discussion

Our findings from the three-site deployment and interviews highlight the ways awareness in MoveMeant usage was similar to, and different from, the awareness discussed in leader interviews, a topic we expand on below. Our findings on cohesion can be seen through the lens of amplification theory, and we propose below a possible intermediate step towards amplification, *surfacing*. In addition, our findings on community identity might be able to be used for shedding light on community behavior to political representatives. Finally, we discuss implications of our findings for community informatics design.

6.4.1 Community Resources

Awareness was one of the key topics discussed by community leaders and users of Movemeant. Awareness of resources available in the community and aware-

ness of the patterns of behavior of members were the main types of awareness that arose from interviews. Some of the resources that community leaders mentioned wanting to increase awareness of were different from the kind that were presented to users in the MoveMeant app. Grocery stores were shown in the app, but resources like addiction centers were not. Part of the reason for this discrepancy could have been due to the fact that the population recruited for the study was not representative of people who would have been visiting those types of resources. However, interview findings suggest the promise of using passive location histories for this type of resource gathering as well (recall that our app offers anonymity). Participants mentioned that the app helped surface places that were previously spread by word of mouth and invisible otherwise.

The fact that the app passively collected locations meant that venues that were non-performative, and might not show up in traditional check-in services like Facebook or Foursquare, could potentially appear in the app (Lindqvist et al., 2011). Places that are useful for drug treatment would likely be kept private rather than volunteered geographic information so as to not contribute to a person's self-presentation (Hecht and Stephens, 2014; Schwartz and Halegoua, 2014). However, extending from Chapters 2 and 3 on the warranting power of location data, our findings suggest that passive sharing of location data might be a way of warranting which resource centers might be more useful than others. Our results thus hint that passive location tracking could potentially align with the efforts of community leaders and be useful for increasing awareness to various types of community resources.

6.4.2 Amplification Theory

Our findings on cohesion show that the MoveMeant app reflected the issues raised by community leaders as well as reinforced pre-existing notions of members of the community. The seemingly homogeneous location data was ascribed social meaning as to belonging to one group or another in the community. Instead of increasing cohesion in the neighborhood, MoveMeant sometimes surfaced the salience of the distinction between groups within the same community. Participants expressed a desire to visit the venues in the app based on an imagined notion of how similar the other people were to them. Across the field sites, there were instances of participants describing being isolated from other people in the community. Similarly, participants did not express a change in their opinions of the community by using the app. Rather, they interpreted the location overlaps as a reflection of both the positive and negative impressions they had already formed about their communities.

Amplification theory, formalized by Toyama, posits that "technology is merely a magnifier of underlying human and institutional intent and capacity, which can themselves be positive or negative" (Toyama, 2011). Amplification theory suggests that technology tends to magnify existing inequalities in communities rather than fix missing elements in a social structure. Toyama identifies three mechanisms behind amplification: differentials in access, the digital divide resulting in varying exposure to technology; capacity, the disparities in education; and motivation, what people want to do with technology (Toyama, 2011). In our study, participants' homophilous tendencies and reported instances of feelings of isolation from the community suggest that the app did not always support feeling of cohesion, but might even exacerbate the

distinction by making more overt the differences within the community.

Our findings are related to but do not quite fit the definition of amplification. The distinction between community-members was not based on the differentials described as the mechanisms behind amplification. While differential access may have been responsible for limiting some users from the app like patrons of the bagel store described by JH1, capacity, and motivation are not responsible for the increased salience of differences between groups since locations were passively logged. Additionally, amplification discusses positive and negative *impact* of technology whereas our findings did not reflect a difference in impact between groups. Rather, the effect on communities seemed to be *perceptual*, and based on members' subjective interpretation of the data.

6.4.3 Surfacing

To account for the differences described above, we propose that there might be an intermediate step prior to amplification, that of *surfacing*. Surfacing suggests that before amplification occurs, technology exposes perceived differences and that these differences might exacerbate amplification. For example, some users of MoveMeant observed that they were visiting different types of venues than others in their community. One can imagine that over an extended amount of time, the Matthew effect might occur (Merton et al., 1968). Colloquially summarized as *"the rich get richer and the poor get poorer,"* the Matthew effect suggests that the locations visited by similar people could reinforce further visits by other people in their in-group. This perceived group-based similarity will occur even though there is no explicit group separation in the app itself. The interpreta-

tion of the data and how it's perceived creates these divisions. The change in behavior that results in separation of people would then become an instance of amplification.

Surfacing proposes that knowledge of data itself can lead to amplification. Instead of being limited to the introduction of new technology, our findings suggest that amplification might be extended to apply to the *awareness* that is brought about by having access to data. Different mechanisms could be causing surfacing than amplification. Surfacing might be caused by intergroup anxiety and homophily (McPherson et al., 2001; Stephan and Stephan, 1985). The tendency of people to prefer their in-group over their out-group results in the interpretation of locations as belonging to one group or another. Similarly, the observed occurrence that "birds of a feather flock together" suggest that people perceive the ability to distinguish between factions of a community based on data alone and could even potentially alter their behavior based on information being presented.

MoveMeant is a type of suprathresholding community informatics and example of network-to-person communication since it shares local, aggregated data of the community with individuals (Carroll et al., 2015b; Hampton, 2016a). However, we imagine that surfacing might also apply to other types of technologies. One example of where surfacing was reported was a deployment of voting devices in stores on a street in the UK that was divided between two types of areas (Koeman et al., 2015). The resulting votes were stenciled onto the pavement to serve as a public display. The authors found that the visualizations promoted comparison and competition between shops and between areas. Similar to what we reported with MoveMeant, the street visualizations provided

people with evidence to support or refute their individual prejudices. Another example can be found with Pokémon Go, a popular geographically-based augmented reality game. Researchers found that the game incentives led to a reinforcement of existing geographic socioeconomic disparities (Colley et al., 2017). Participant responses indicating that rural areas were "boring places" to play the game serve as instances of surfacing the distinction between advantaged and disadvantaged areas as well as urban and rural places. Nextdoor, a local social media service for neighborhoods, also showed surfacing. Nextdoor allows people to post to a message board once they have proven that they are physical residents of a neighborhood (Masden and Edwards, 2015). The service was reported to have "become a forum for paranoid racialism" where people would use racial profiling to identify suspicious people in the neighborhood (Hempel, 2017). Nextdoor could be viewed as having surfaced the racial divide inside neighborhoods.

6.4.4 Representation

One of the key issues that was brought up during interviews with community leaders across the different field sites was political representation. Leaders discussed problems including placement of drug addiction clinics and sanitary waste disposals, officials acting against the interest of members of the community, and bribery of other community organizations to push forward politicians' agendas.

The interview data regarding community identity suggests that the information from the app could potentially be used to aid in certain representation

issues through increased awareness. For example, as EH2 explained, the venue patterns in the app could expose whether the new Whole Foods was being frequented by members of the community or not. If data showed that the new establishment was not actually being utilized by the existing members of the community, and this information was presented to the representatives for the district, it would be difficult for them to argue that the storefront was a benefit for the community. In other words, the aggregated and anonymized data could potentially increase awareness to political representatives of which resources were being utilized by members of the community. This awareness could potentially prompt representatives to address other issues discussed by community leaders and participants like gentrification.

While we do not claim that political representatives would use this kind of data to inform their decisions, our data suggests that having this information available could at least aid community leaders in some of their work by making visible the otherwise invisible patterns of community. In the same way that Heath and Luff showed how workers engage in invisible work with technology and each other in the Line Control Rooms in the London Underground (Heath and Luff, 2000), the technology used in our app has the potential to reveal how members engage with different places in their community. The potential positive change that could come out of this technology, however, would not be possible without the involvement of community leaders, which is consistent with amplification theory.

6.4.5 Design Implications

This work has implications for the design of services that have large quantities of user data available as well as for and usage of community apps.

One implication of our findings is the benefit of restricting or filtering information presented to users. The challenge of gathering information on the Internet has shifted to one of information retrieval and finding useful data (Athukorala et al., 2016). Our interviews suggested that location information was particularly useful to be restricted to that of locals since they have knowledge that is specific to the area. These findings could be generalized from location information to other areas as well, suggesting that beyond the information itself, *the attributes* of the person who is providing the information could make a difference. A few participants expanded beyond the app's local-focus and discussed ways in which other user-narrowing might be useful. For example, EH5-29M said, *"If I want to look at Yelp for an Indian restaurant, I will probably look for some Indian names and see what the Indian reviewers said about the Indian restaurant."* Similarly, a Cornell Tech participant (CT9-25F) said that she would find value in finding out about tech-related events from her peers. These findings suggest that other systems that rely on user-generated content could potentially benefit by allowing users to filter results or reviews by certain users. For example, TripAdvisor could allow users to filter results from other people with families.

Our findings on surfacing also have implications for the design of community apps. The different clusters of locations that would naturally form for communities could be used to motivate users to visit venues outside of the typical behavior of their community. For example, apps like Yelp could favor locations that were typically not in one's group by placing them higher in search

results. Another possibility would be to compare separate clusters, identify similarities between them, and emphasize the similarities to encourage people to visit places similar to, but not part of, their typical community places. Clusters could also be brought to the attention of community leaders for them to be able to identify venues for community events that are more inclusive of different groups. These design suggestions aim to overcome people's tendencies towards homophily by nudging them towards more diverse places.

6.5 Limitations

As with our interviews in Chapter 5, our participant-base was only people in New York City. Recruitment was limited to certain sites, which may have restricted the kind of data collected and populations reached. Self-selection bias may also have led to a user base that was overly technologically-adept and not reflective of the breakdowns of the communities studied. However, we do not believe this limitation decreases the validity of our work since the distinctions between groups within a community are a key part of our discussion and analysis. Another limitation is that we did not create an app that is likely to have sustained use by the communities. Participants used the app infrequently, which partly might be attributed to the fact that we conducted interviews after the main features of the app had been designed. However, we believe this methodology allowed us to gain insight, both positive and negative, into how LBPHD might be interpreted by people, which we would not have learned had our main goal been solely to create an app based on our interviews with community leaders and members. Following a research through design methodology instead allowed us to learn how communities might be affected by this increasingly

prevalent type of data that is growing in its collection and use.

6.6 Conclusion

This work described the deployment of MoveMeant, a community app that uses anonymized and aggregated location information for network-to-person communication. Across three field sites and interviews with 30 community members, we show how the information in the app engaged with the issues of awareness, cohesion, and community identity. We synthesized our findings to propose surfacing, the effect of technology to make differences within a community more salient, as an intermediate step towards amplification. We discussed how the information could potentially be used by community leaders as a tool for political action and the design implications of this work.

In the next chapter, I synthesize the knowledge that has been collected on location tracking throughout this dissertation work and discuss how it connects with relevant social theories.

CHAPTER 7
DISCUSSION

This dissertation described an investigation of the social meaning of LBPHD, location-based post-hoc data, which uses mobile phones to record people's location histories. Through interviews with users of a LBPHD dating app, happn, we learned about the warranting power of location data. We extended location overlaps from interpersonal data to community-level data with MoveMeant, a privacy-aware app that aggregates location histories and anonymously shares them with community members. After iterating on the design of the app and piloting it with a community in the wild, we conducted an expanded deployment of MoveMeant across three different communities in New York City. Finally, we interviewed leaders in those communities to gain an understanding of the challenges that their communities face and the potential impact that this type of technology could have on the greater socio-technical infrastructure.

Our findings on LBPHD and its use in communities relate to the social theories discussed in Chapter 2. We find support for location as a social signal and the potential for LBPHD to bring increased awareness of third places, which are valuable to local community. However, the public private divide seems to possibly be exacerbated, and exposure and parochialization take different forms with this technology with potentially negative implications.

This research serves as support for Lofland's argument that location information provides an important social signal (Lofland, 1985), an example of "spatial ordering" described by Lofland. Our findings on MoveMeant suggest that LBPHD has the potential to reveal third places, which Oldenburg noted has benefits for both the individual and community (Oldenburg, 1989). By bring-

ing third places to the forefront, LBPHD could help combat the decline of third places that Oldenburg laments. Increasing knowledge of the types of places that a community frequents could also contribute to Bourdieu's cultural capital (Anheier et al., 1995). The potential of cultural capital to convert to social capital could possibly revitalize community spaces through increased awareness. One mechanism through which social capital could increase is by people in the community progressing through Grannis' stage 2 (casual encounter) to stage 3 (intentional initiation of contact) (Grannis, 2009). If people visit the locations and third places from the app, then they increase their likelihood of casual encounters that can lead to initiation of contact. However, the development of social capital is not possible if barriers keep people from visiting the locations found in the app.

Our findings suggest that social barriers may exist that would inhibit the social and cultural capital benefits that might arise from awareness of LBPHD. While the aim of MoveMeant and the use of location history in design was to bridge the separation between public and private life described by Arendt (Arendt, 1958) and Habermas (Habermas, 1991), we see the possibilities of LBPHD to instead further the divide. Across different communities, participants who used MoveMeant reported feelings of isolation when their own patterns differed from the popular locations of the community. LBPHD blended the public and private life by making public to the community private location histories, but in doing so, made it apparent when people's private histories were different from everybody else's. This awareness of the self in relation to others would be unknown, or at least more implicit, without the data from the app. It is possible that with a larger sample size, those that felt isolation would have identified with a smaller niche within the community of people who go to the

same types of places as them. Our sample may not have been large enough to capture such interactions. Nonetheless, our findings suggest that blending public and private life can sometimes lead to feelings of isolation, which may prevent people from putting effort into engaging with the community.

Exposure, which was discussed by Sennett and Simmel in their examination of urban life, takes a different form in LBPHD. For MoveMeant, exposure was indirect rather than direct, since people were exposed to other's location histories rather than people themselves. LBPHD in the app was also aggregate exposure rather than individual; people were aware of locations for the community as a whole, not for individuals. To Simmel, this type of exposure may seem more manageable than urban exposure, since people would be able to access the data at will indirectly and therefore not need to build a defense mechanism against others (Simmel, 1903). To Sennett, the limited exposure to only location data may not fully capture the essence of the human experience that comes with aggregated data (Sennett, 1992). While Jacobs finds diversity to be necessary for successful cities (Jacobs, 1961), our findings suggest that inhabitants may make sense of the diversity by creating divisions between groups within the same community. The high levels of diversity that Simmel described is still apparent in the lack of cohesion noted by community leaders in urban neighborhoods. In the same way that interacting with others can make both similarities and differences apparent, as Sennett describes happened in his interaction with an Indian merchant scolding his son, so too is the data from LBPHD interpreted both for similarities and differences. In the case of LBPHD, differences take the form of surfacing, whereby participants interpret the locations as belonging to particular subgroups within the community.

Our findings suggest an extension of the definition of parochialization. Humphreys asserted that parochialization is "the process of creating, sharing, and exchanging information, social and locational, to contribute to a sense of commonality among a group of people in public space" (Humphreys, 2007). Our findings suggest that LBPHD can be used for parochialization, since people were able to extract similarities between themselves and others based on location overlaps. However, rather than only *commonality*, LBPHD can also contribute to a sense of *difference* between groups of people. Our findings on surfacing support the notion that sharing location information can also emphasize divisions between people who visit different places. Perhaps the commonality inferred from people within one particular space may contribute to a sense of differences between places. The ability to feel similar to people in one place might be predicated on the ability to differentiate oneself from people in other places. There may exist a dualism between parochialization described by Humphreys and the effects of surfacing as identified through the current work; the former may not be possible without the latter.

CHAPTER 8

CONCLUSION AND FUTURE WORK

Taken together, this research provides a hopeful but cautious view of using LBPHD for community building. On one hand, location data is warranted, and provides a greater level of uncertainty reduction than some other types of data in both interpersonal and community apps. MoveMeant shows that there are ways of collecting and presenting LBPHD that does not compromise user-privacy while also providing users with local knowledge. LBPHD has the potential for strengthening local ties by connecting individuals through shared interests and allowing for discovery of third places. However, the greater awareness that comes from LBPHD may not help bring communities together. In fact, our findings suggest that being presented with location data may have the opposite effect of surfacing implicit distinctions within a community and exacerbating the existing challenge of creating cohesion in diverse neighborhoods. The challenge is whether or not the technology is able to overcome the tendency of surfacing that people naturally seem to form.

Future work on the meaning of location overlaps could approach analyzing MoveMeant using a quantitative methodology to assess whether presenting different kinds of information might overcome the effects of surfacing. Increasing exposure or increasing perceived homophily between different individuals could potentially counteract some effects of surfacing. Different versions of MoveMeant could be deployed to assess the impact of community location awareness on attitude and behavior towards other people in the community. The conditions could be differentiated based on the types of alerts that the app would send users. The experimental conditions could include information

about the community to the user. For example, one type of alert could say "5 people from your community also went to [Location Visited]." Contrastingly, a control condition might send alerts to users that only relate to their personal location history, such as "[Insert Name Here] is one of your go-to places," or "You tend to go to [Location Type] more often in the evenings." The experimental alerts and survey questions could present different kinds of information to users to provide a contrast between the social mechanisms of exposure, homophily, and cultural capital described in Chapter 2. Survey questions and a measure of sign-ups for a community volunteer event or other pro-social measure would be able to assess if there is an attitudinal or behavioral difference between the conditions. The Bridging Social Capital Scale (Ellison et al., 2007) and the Inclusion of Self in Other Scale (Aron et al., 1992; Mashek et al., 2007) could be used to assess how much people feel like they are part of the community. Exposure could be measured by asking the frequency with which they encountered people from their community in a place that they visited in response to the app, the Homophily scale (McCroskey et al., 1975) could be used to measure how similar people perceive their community members to be to themselves, and the Intergroup Anxiety scale (Islam and Hewstone, 1993) could be used to measure perceptions of differences. This kind of study would be useful to better understand the extent to which surfacing occurs, the potential mechanisms behind it, and whether there are ways of presenting data that can overcome such effects. Future work could also use sources of data other than location and determine the prevalence of surfacing with alternate types of information.

Other organizations are beginning to use LBPHD for social benefit. Decode (Decode, 2017) is a consortium of different organizations across the European Union that is exploring how people might use their own data traces for

the good of the wider community. Uber's Movement (Uber, 2017) provides data from people's rides to aid urban planners in their work. This research suggests the promise behind such efforts in increasing awareness, but also the potential danger of unintentionally surfacing distinctions within the community at the same time. Like architecture and city organization, data is given meaning by the way that people interpret and use it. More and more data is being collected and efforts taken to make that data available to the public. Taking into account the potential unintended effects of shared data for community cohesion is a concern for the future that we as designers and researchers should acknowledge and better understand.

APPENDIX A

APPENDIX A: HAPPN INTERVIEW GUIDE

App Basics

1. How did you learn about this app?
2. How long have you been using it? And frequency?
3. What do you think of it?
4. Can you walk me through how this app works?
5. What do you usually pay attention to when using the app?

Location Overlaps

1. How do you interpret the number of times crossed path?
2. Do you open the profile to see the map (where and when you crossed)?
3. What are the usual number of times crossed you see?
4. What do you think of people you just crossed path for the first time?
5. What do you think of 20 some times?

Interactions with Others

1. Do you have any interesting stories to share about the app?
2. Have you met anyone through the app in real life?
3. Did you ever see anyone in real life that appeared in the app?
4. What happens when you have a match?
5. How do conversations usually start and unfold?

Comparison to Other Apps

1. Do you use other dating apps? Which ones?

2. How does Happn compare to others, such as Tinder or OkCupid?

General Thoughts

1. What do you like about the app?
2. What do you dislike about the app?

APPENDIX B

APPENDIX B: MOVEMEANT PILOT INTERVIEW GUIDE

Interview 1: Pre-MoveMeant Usage

Demographic Questions

1. How long have you lived in this neighborhood?
2. How much longer do you expect to live in this neighborhood?
3. How often do you participate in activities with members from this neighborhood?
4. How strong is the sense of community in this neighborhood?

Background Questions

1. How would you describe your relationship with your neighbors?
2. What was the last memorable interaction you with a neighbor?
3. Do you participate in any locally-organized activities or groups?

Geolocation Attitudes

1. Which geolocation apps have you used?
2. What benefit do you get from using them? Or why dont you use them?

Expectations about Movement

1. What was your main motivation for downloading Movement?
2. What expectations do you have about using Movement?
3. Are there certain locations that might be more interesting to you than others?

Interview 2: Post-MoveMeant Usage

General experience with MoveMeant

1. Can you tell me about your experience with Movement?
2. How often did you check the app?
3. How often did you read the summary emails?
4. Did anything surprise you when using Movement?
5. Did you ever find the information useful?
6. What would you want to change about Movement?
7. Would you want to continue using Movement?
8. Did you remove any venues? If so, why? If youre willing to share, which ones were they?

Changes in Relationships

1. How would you describe your relationship with your neighbors?
2. What was the last memorable interaction you with a neighbor?
3. Did you notice any changes to the ways that you interacted
4. Did you notice any changes in the ways that other people interacted with each other?
5. Do you have any anecdotes to share?

APPENDIX C

APPENDIX C: COMMUNITY LEADER INTERVIEW GUIDE

Background Questions

1. How would you describe the Cornell Tech/East Harlem/Jackson Heights community?
2. How close do you think the community is in general?
3. What gives you that impression?
4. Describe the general population of your community.

Community Work

1. What is your involvement in the community?
2. How long have you been involved?
3. What began your involvement?
4. What are the main initiatives youre working on?
5. What are things that your organization has achieved in the past?
6. What remain obstacles that your organization is working on?
7. What is your relationship with other local community organizations?
8. How have you considered integrating technology into your initiatives in the past?

APPENDIX D

APPENDIX D: MOVEMEANT LARGE-SCALE INTERVIEW GUIDE

Demographic Questions

1. How long have you lived in this neighborhood?
2. How long do you plan on staying?
3. How did you decide to live here?

Background Questions

1. How would you describe your relationship with your neighbors in this neighborhood?
2. How close knit would you say the East Harlem community is?
3. Do you participate in any neighborhood groups or organizations?

Geolocation Attitudes

1. Which geolocation apps have you used?
2. What kind of content do you tag your location for? Why?
3. What benefit do you get from using them? Or why dont you use them?

MoveMeant Usage

1. Did you have any expectations about using Movement?
2. Can you tell me how MoveMeant works?
3. Are there certain locations that might be more interesting to you than others?
4. Can you tell me about your experience with Movement?
5. How often did you check the app?

6. How often did you read the summary emails? [if never] could you find one of the old emails and open it now?
7. Did you ever find the information useful? Why or why not?
8. Did Movemeant ever come up in conversation?

Prompt User to Open MoveMeant App

1. Could you open up the MoveMeant app on your phone?
2. What do you think of the venues that are the top in your community?
3. Are you surprised by any of these places?
4. What do you think revealing does?
5. If youre comfortable with revealing, could you reveal for a few places? [Make sure they know that others can see who else revealed there]
6. How did you pick those places to reveal?

Privacy

1. Were you ever concerned about the privacy of sharing your location?
2. Why or why not?

Attributes about the Community

1. Does it make a difference to you that its people in your neighborhood versus anybody in the world whos using the app?
2. What do you think this information says about the people in your neighborhood?
3. Would you have expected places to come up that didnt? Why or why not?
4. What kinds of information or places from your neighbors would be useful to know?

5. If more people were using the app, how do you think the places would be different?

Features

1. What would you want to change about MoveMeant?
2. Would you want to continue using MoveMeant?
3. What features would be useful to see?
4. Were thinking of adding alerts that would send a notification if someone else visits a location that youve been to - would this be interesting for you?
5. Would you like a location?
6. Would you be interested in seeing notes that people leave for a location?

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